STUDY

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European Parliament

Regional connectivity through an adequate transport infrastructure

Regional Development

Policy Department for Structural and Cohesion Policies
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RESEARCH FOR REGI COMMITTEE

Regional connectivity through an adequate transport infrastructure

This study provides an overview of the aspects of regional connectivity through adequate cohesion policy investments in rail and road transport infrastructures, mostly in the programming period 2014-2020. In detail, this analysis covers all types of transport-related investments (for goods and people) financed from the European Regional Development Fund and the Cohesion Fund. Moreover, the study provides concrete policy recommendations relevant to EU decision-makers on how to improve future EU Cohesion Policy investment in the domain of regional connectivity.

This document was requested by the European Parliament's Committee on Regional Development.

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LIST OF ABBREVIATIONS

CEF	Connecting Europe Facility
CF	Cohesion Fund
ECP	EU Cohesion Policy
EC	European Commission
EGTC	European Grouping of Territorial Cooperation
EP	European Parliament
ERDF	European Regional Development Fund
EU	European Union
GDP	Gross Domestic Product
GIS	Geographical Information System
OECD	Organisation for Economic Co-operation and Development
OP	Operational Programme
TEN-T	Trans-European Transport Network
TIA	Territorial Impact Assessment

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EXECUTIVE SUMMARY

Introduction

This report analyses the contribution of EU Cohesion Policy (ECP) in improving regional connectivity in all types of transport-related infrastructure, financed from the European Regional Development Fund (ERDF) and Cohesion Fund (CF), in particular, during the programming period 2014-2020. The analysis was mostly supported by a literature review and data analysis from approved ECP project databases as well as regional (NUTS 2) statistical databases of economic indicators (employment and GDP).

From the literature review, it was possible to confirm a general consensus that investment in transport infrastructure is very important in enabling socioeconomic development processes by providing adequate accessibility to people, goods and businesses. Conversely, some of these investments tend to have negative environmental impacts, especially if they do not regard sustainable and smart transport systems.

As with other public policies, ECP funding should be spent wisely (the relevance factor), effectively (goals vs results) and efficiently (resources vs results). In terms of regional accessibility, this means that only transport accessibility investments that can effectively provide a proven positive impact on territorial (local, regional, national, EU) development trends are to be approved. Indeed, an historical analysis of the ECP support to improve and modernise regional transport accessibility in some EU Member States, like Portugal, demonstrates a dual general impact: for one, the construction of modern motorway connections significantly improved territorial development processes. Conversely, the excessive concentration of ECP investment in road infrastructure vis-à-vis the modernisation and expansion of existing railway networks proved not to be the optimal policy and strategic decision for improving the mobility of people and goods in a sustainable and effective manner.

EU Cohesion Policy support to regional accessibility (2014-2020)

In the past years, the EU's eastward territorial expansion led to an increasing allocation of ECP funding towards modernising transport regional accessibility in the new and less socioeconomically developed EU Member States. This justifies that in the 2014-2020 phase of the ECP, 16% of its total spending was used to support transport accessibility. If joined with the financial support for energy infrastructure, transport infrastructure was the ECP area that received the most funding in overall terms. The rationale behind this lies in the substantial financial support required for regional accessibility needs. Unsurprisingly, this funding benefited 'Cohesion Fund countries' (Bulgaria, Croatia, Cyprus, Czechia, Estonia, Greece, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia and Slovenia) and in particular Poland, Romania, Czechia, Slovakia and Hungary, respectively.

Overall, the distribution of ECP (2014-20) funding per EU Member States and regions (NUTS 2) in the domain of regional transport infrastructure is justified in view of the EU region's need to improve regional accessibility. The question is: how impactful were the EUR 82.3 billion spent in this domain on the development of the affected regions and on increasing their overall regional accessibility levels in an EU context? As most experts in transport infrastructure would reply, it is not easy to assess the main impacts of transport infrastructure, as related financed projects usually serve to renovate or expand existing transport networks and also because their implementation tends to expand the seven years of ECP phases. Indeed, based on the collected data, there is no visible positive correlation between economic development trends in EU regions and ECP investment in regional accessibility. Crucially, policies do not act in isolation and hence many other investment policies contribute to development trends as well, making it complex to identify precisely the potential positive impacts of ECP on

enhancing regional accessibility. For that, a sound Territorial Impact Assessment (TIA) methodology like the Target TIA could provide deeper multidimensional impact analyses of ECP investment in transport accessibility in a selected territory. Such methodology, however, requires the collection of a wealth of data and time to be effectively implemented, which is out of the scope of this report.

Challenges and pathways for improving EU Cohesion Policy to support regional accessibility (2014-2020)

Despite the challenges of analysing the main impacts of ECP on improving regional accessibility through transport infrastructure, a few main conclusions can be drawn from the collected information:

- **ECP is still a vital financial tool to improve regional accessibility performances across the EU territory.** It has also been crucial to address regional accessibility imbalances in the EU, as it has allocated a larger financial package to EU regions that require modernisation and improvements in their transport infrastructure connections. As such, future ECP programming periods should continue their effort to make the EU territory adequately linked with a modern, sustainable, regular, smart and fast transport network that serves the needs of people and businesses.
- In view of the regional accessibility needs in many EU regions, **ECP should maintain or increase its investment** to continue the process of improving regional accessibility across the EU territory. However, these investments should target the construction or renovation of high-speed train connections that can substitute short-distant flights and provide an effective connection between major and medium-sized towns in a national context. Furthermore, rural areas should also be adequately served by interconnected transport networks, as access to public transport should be regarded as a service of general interest for all citizens. Moreover, support for more sustainable transport infrastructure should be a policy priority, not only at the urban level but also at the regional, national and EU levels.
- At the transnational and cross-border level, **ECP should increase its funding for the Interreg A and B programmes**, as all existing studies point to the fact that **there are still many cross-border EU regions with low levels of cross-border transport accessibility**. In past years, several Interreg projects (see case studies section) have contributed to mitigating this persistent border barrier in several EU cross-border passages, which greatly affects the lives of EU citizens and especially many of the around two million European cross-border commuters. In this context, the financial support for enhancing cross-border and transnational transport infrastructure crossings through ECP investments needs to be increased. This amplification is necessary to implement improvements in numerous EU cross-border areas, especially those predominantly characterised as rural. Moreover, these cross-border transport infrastructures need to be appropriately linked with existing regional transport infrastructure to increase interoperability.
- **ECP should also contribute to increasing support for the TEN-T network** that effectively links regional accessibility gaps between EU major and medium-sized cities, following a sustainable and smart mobility strategic implementation rationale. Additionally, priority should be given to ECP investments in regional connectivity to establish metro network systems in all EU capitals and major cities, along with direct train connections to their respective airports, which remains far from achieved, particularly in Eastern EU Member States.

1. INTRODUCTION

1.1. General objectives and expected outcomes

This report aims to provide useful, authoritative and timely information to Members of the REGI Committee about regional connectivity through an adequate transport infrastructure. Moreover, the report elaborates on the aspects of regional connectivity through adequate Cohesion Policy investments in rail and road transport infrastructures and offers a range of concrete policy recommendations relevant to EU decision-making, with a particular focus on the role and competences of the European Parliament.

1.2. Scope and objectives

This report starts by providing an overview of the spending of the Cohesion Policy to the transport infrastructure in the programming period 2014-2020. This analysis covers all types of transport-related investments (for goods and people) financed by the European Regional Development Fund (ERDF) and Cohesion Fund (CF). Subsequently, a detailed analysis is provided on the support of the Cohesion Policy (during the period 2014-2020) to the investments in regional connectivity: (i) investments in transport infrastructures connecting urban and rural areas; and (ii) investments in transport infrastructures with regional dimension and inter-regional aspects and their impacts on the development of local economies. The next section illustrates the analysis with a set of examples of success stories or initiatives (e.g. projects, programmes or larger regional policies) supported in the programming period 2007-2013 and/or 2014-2020. Finally, the last section offers a set of policy recommendations for EU policy-makers, first and foremost for Members of the European Parliament, on what could be done (especially at the EU level) to improve regional connectivity through investments in an adequate transport infrastructure.

1.3. Gaps of knowledge and research needs

According to a report by the Organisation for Economic Co-operation and Development (OECD) "the economic benefits of improved accessibility are often overlooked and almost always not explicitly valued in traditional transport appraisal and evaluation practices" (...) "The rare examples of economic valuations undertaken to date demonstrate that the magnitude of potential benefits from improved accessibility is often large enough to offset the costs" (OECD, 2017: 9). Despite these positive remarks, existing literature on the impact of transport infrastructure varies substantially on its potential impacts (Sá Marques, 2004). It is undeniable, however, that transport accessibility should be regarded as one of the essential services of general interest in the EU. As a recent report stressed, "a number of dimensions affect the extent to which individuals can access transport, including cost (affordability), infrastructure and frequency (availability) of services as well as ensuring that both physical carriages and online interfaces are accessible for persons with disabilities and persons with reduced mobility to achieve access for all on an equal basis (digital/physical accessibility). This also results in a large number of possible disadvantaged groups, including low-income households and marginalised Roma communities that may struggle with the cost of transport; those in rural and remote areas where there may be a deficit of services; women or people with caregiving duties who might perceive the services as unsafe or spend an excessive portion of their time in transit; and older people, persons with disabilities and persons with reduced mobility" (EC, 2023: 33).

Commonly defined as "the potential of opportunities for interaction and as a measure of the relative ease with which individuals overcome spatial separation to reach their desired activities" (Chen et al., 2020: 6), accessibility is particularly challenging in rural areas. As Velaga et al (2012: 102) postulate, "constraints in rural transport infrastructure and services are often compounded by limitations in the

development and resilience of technological infrastructures. In this context, there is a significant disparity between urban and rural communities" when it comes to the degree of regional accessibility. However, contrary to popular belief, in certain cases, areas of highest employment attractiveness and accessibility are not always in the central or core areas of their respective regions (Horner, 2004). Even so, existing studies tend to positively correlate levels of transport accessibility and economic competitiveness (OECD, 2017), whereas land development in smaller cities can be mainly explained by the improvement of regional accessibility and population growth (Shen et al., 2017).

Ultimately, for Straatemeier & Bertolini (2020), increasing accessibility leads to more integrated transport strategies. Similarly, building on the concept of knowledge accessibility, Andersson & Karlsson (2007: 134) also conclude that "a region with good physical infrastructure and regions with many knowledge resources will have high knowledge accessibility. Therefore, the extent of knowledge flows is expected to be large. Since knowledge flows are related to mobility and interaction opportunities, the location of knowledge production activities and the consequent knowledge-accessibility structure should affect the pattern of growth across regions". However, there is a common recognition that assessment methodologies to analyse ECP effects from financing transport infrastructure are scarce and uneven (López et al., 2008). For these authors, however, based on their case-study analysis, "cohesion has improved for the road mode, while regional disparities have increased for the rail mode" (López et al., 2008: 277). In conclusion, despite the existence of many studies on regional accessibility, no major detailed study was found on assessing the main impacts of ECP on transport accessibility in EU territory.

2. METHODOLOGICAL APPROACH

2.1. Methodological pre-conditions for assessing regional connectivity through an adequate transport infrastructure

The selected methodological approach aligns with the intention of the European Parliament (EP) to focus mainly on the economic effects of the implementation of ECP (2014-2020) financed projects related to transport infrastructure (ERDF and CF). Initial conversations with the EP unveiled a specific interest in analysing how these ECP investments relate to the level of regional employment in the EU territory. The selected case studies' analysis is supported by existing information (literature and online sources) regarding the project budget, its main goals and its main achievements.

In the context of a knowledge gap on methodologies for assessing the impact of transport infrastructure and the lack of adequate data at the regional level, the proposed methodological approaches were selected based on the following preconditions:

- Simplicity vs relevance: A basic precondition of any effective policy evaluation methodology is to achieve a balance between producing relevant results and maintaining simplicity (Medeiros, 2020). Hence, the proposed methodology should use relevant analytical elements that can be applied during the time frame of the project, which is quite limited to five months. Moreover, the project is being conducted by merely one researcher. In this context, the counterfactual element to the analysis (EC, 1999) is not possible in this specific report, as it would imply access to a wealth of data at the EU level, which is difficult to obtain and time-consuming.

- Data availability: Ideally, for relating ECP (2014-2020) investment in regional accessibility transport infrastructure, the analysis should embrace the complete project database of the approved ECP projects in this policy domain to relate their investment distribution per EU NUTS 2 and the economic trends of those NUTS on employment and Gross Domestic Product (GDP). However, only data related to the 2014-2020 ECP-financed projects on transport accessibility with very high budgets was provided by the European Commission (EC).

- Literature availability: The analysis of this report is mostly based on a literature review. Here, the last two EU Cohesion Reports provide valuable and updated information for this report. Moreover, literature on the case studies was collected from EU project databases, reports and online sources.

- Economic focus: The impact assessment of transport infrastructure is expressed in many dimensions of territorial development, including social, economic, environmental, planning and governance-related components. However, this report specifically directs its focus, in the upcoming two chapters, towards the economic dimension of development. The analysis will delve into key economic components, including employment and GDP.

2.2. Methodological approaches for transport impact assessment

In 1996, the EC published a report providing an overview of the state of the art in methodologies for the assessment of the impacts of strategic transport initiatives (EC, 1996). Ultimately, this report discussed "techniques applicable to assessing spatial socio-economic impacts and environmental impacts,

particularly in the context of the Trans-European Transport Networks" (EC, 1996: III). Among these, one can summarise the following ones:

- Interview and questionnaire methods, including the Delphi methodology.
- Profile approaches.
- Potential approaches, including the Keeble model.
- Input-output modelling.
- Spatial interaction simulation models include gravity models, the Garin-Lowry model and the MEPLAN approach.
- Other measurement methodologies include qualitative methodologies, Geographical Information System (GIS) methodologies, production functions and scenario approaches.

Beyond these methodologies, the same report discusses the use of methodologies to assess the main environmental impacts of transport. Moreover, an integrated methodology is also presented as well as a proposed framework for assessing transport policy initiatives is also advanced and supported by the following core elements for a wider assessment framework in which spatial socioeconomic impacts should incorporate five broad analytical categories (EC, 1996: 7.2):

- Business and industry.
- Residential.
- Tax revenue and society.
- Regional and society.
- Resources.

When it comes to the assessment of Trans-European Networks (TEN), the same report highlights the need to analyse the following domains:

- Contribution of the project towards economic growth.
- Development of the internal market.
- Integration of EU territory.
- Strengthening of economic and social cohesion.
- Promotion of sustainable mobility.
- Specific national objectives.
- Contribution towards the achievement of EU environmental objectives.

A summary figure is presented in the mentioned report (EC, 1996: 7.8) on the relationship between costs and benefits of transport infrastructure in several analytical components (see Annex 1). Since this report was published, a wealth of information on policy impact assessment methodologies has been produced and shared by the EC, including the MEANS (EC, 1999), the two EVALSED sets of documents (EC, 2008, 2013) and the EC impact assessment guidelines (EC, 2009). More recently, the territorial impact assessment (TIA) methodologies have gained ground as a more holistic policy evaluation framework and have been applied in assessing the implementation of ECP funds at several territorial levels and policy domains (Medeiros, 2014a, 2014b, 2017).

As related to existing EC evaluating reports on the domain of ECP transport accessibility investments, by 2006 one was published focused on the strategic evaluation of transport investment priorities under the ECP period of 2007-2013. This report presented a potential impact assessment of several scenarios

of transport investment priorities based on a SASI model (see Annex 2), presented as a "recursive-dynamic simulation model of socioeconomic development of 1330 regions in Europe. The model was developed to assess socio-economic and spatial impacts of transport infrastructure investment and transport system improvements. It has been applied and validated in several large EU projects, including the IASON and ESPON projects. The SASI model differs from other forecasting models of regional development by modelling not only production (the demand side of labour markets) but also population (the supply side of labour markets). Regional production by industry is forecast by regional production functions containing production factors such as capital, labour, regional endowment and accessibility. Regional population is forecast by a demographic model including fertility, mortality and migration" (EC, 2006: 66).

To assess economic competitiveness trends resulting from policy investments in transport, the SASI model uses indicators related to: (i) Average speed of interregional road trips (kph); (ii) Average speed of interregional rail trips (kph); and (iii) GDP per capita (Euro) (EC, 2006: 68). More recently, the EC final report on assessing ECP (2007-2013) transport-financed projects (EC, 2016) did not present in detail the methodological approach used. Even so, it was possible to identify indicators obtained to correlate ECP investments in transport infrastructure with: (i) Change in road infrastructure 2007-2013 (km); (ii) New roads co-funded by Cohesion Policy (km); (iii) Co-funded new roads/change in road infrastructure (%); (iv) railway network 2013 (km); (v) Cohesion Policy new railroad; (vi) (km) Cohesion Policy reconstructed railroad; (vii) (km) rail network enhanced with Cohesion Policy assistance.

Other literature proposes additional methodological approaches to measure, for instance, transit accessibility. Here, Malekzadeh & Chung (2020) identify the following approaches: (i) system accessibility models (accessibility to transit stops); (ii) distance-based system accessibility approaches; (iii) gravity-based system accessibility approaches; and (iv) utility-based system accessibility approaches. All of them are quite specific to analysing accessibility patterns, alongside the models they identify in Annex 3. Additionally, Fang et al. (2010) propose an innovative and sensitive indicator of regional space–time accessibility that adds to existing gravity-based accessibility, cumulative accessibility, utility-based accessibility and other concepts of individual space–time accessibility. Instead, Elshahawany et al. (2017) propose a spatially computable general equilibrium (SCGE) model to estimate the economic impacts of changes in transportation costs, based on the assumption that "public investments in transportation can increase economic performance both in direct and indirect ways" (Elshahawany et al., 2017: 257). Their research, however, is largely based on an analysis of the changes in travel times. Additionally, these authors mention several methods that have been deployed to measure the economic impacts of transport infrastructure:

- Qualitative survey.
- Detailed market studies.
- Comprehensive economic simulation models.
- Social Cost Benefit Analysis (SCBA).
- Input–Output Analysis (I–O).
- Computable General Equilibrium (CGE).

Likewise, Antunes et al. (2002: 283) reiterate the conclusion that "accessibility is a key factor in defining the quality of life and potential for development of both cities and regions" and highlight the importance of considering spatial planning processes to maximise the potential positive impacts of transport investment infrastructure. From a different angle, Shen et al. (2017), when assessing the accessibility improvement, used land development data related to demography, land cover and transportation

networks for the selected methodological approach. Here, they mention the location-based method, which is based on two measures: (i) weighted average travel time (WATT) and (ii) economic potential.

When measuring the regional cohesion effects of large-scale transport infrastructure investments in Spain, López et al. (2008) used a Geographical Information System (GIS) programme with several accessibility indicators related to location, potential, network efficiency and daily accessibility location to draw accessibility maps. In turn, Stelder (2016: 984), while recognising that "regional accessibility is generally considered to be an essential prerequisite for regional economic growth", decided to focus on indicators related to measuring distance or any other definition of transport costs and a parameter indicating the distance-decay intensity. In turn, Chen G. et al. (2013: 132) review several models and methods to analyse the regional impacts of high-speed rail. They conclude that "many researchers and policy-makers often use the measures that are easier to compute, interpret and communicate, such as travel time, travel speed, network density, congestion levels, etc. This type of measurement has the major disadvantage of not reflecting the spatial components, amount, distribution and type of activities in the destination areas. Measures of accessibility should consist of two elements: the attractiveness of potential destinations (e.g. employment, gross domestic product (GDP)) and the cost of reaching the destinations (e.g. travel time, generalised travel cost)". Annex 4 describes the main elements influencing regional development trends through the implementation of high-speed rail projects.

Crucially, Wenner & Thierstein (2020: 63) sustain that "potential accessibility measures are calculated by summing up all destinations that can be reached from a point in a network, weighted by their attractiveness (e.g. economic mass or population) and inversely weighted by their distance. They rest on the assumption that the likelihood of personal interactions and consequently travel from any location to another destination depends on the number of opportunities the destination presents and the difficulty to reach it". In turn, Stone et al. (2010: 4) invoke the GTAP model, which "draws on a set of economic accounts for each country or region, with interactions between regions and sectors captured within a consistent framework". Also interesting is the approach used by Guzman-Valderama (2013) to propose a multiregional input-output integrated approach to modelling the impact assessment of transport policies (see Annex 5). This author recognises that economic impact assessment models of transport policies are still in the development phase. He then highlights the RUBMRIO model to assess the economic impacts of transport, which is a random utility-based multiregional input-output model approach.

When analysing cross-border transport in Europe, Medeiros (2019b) created a cross-border transport permeability index, which includes data related to demography, transport and commuters' flows (see Annex 6). This methodology was adopted by a recent EC report (EC, 2021), which copes with the current data limitation reality. "The analysis identified 57 obstacles to Cross-Border Public Transport (CBPT) service provision, the majority of which are due to administrative issues (roughly 60%). About 20% of obstacles concern either EU or national legal frameworks. Finally, another 20% of CBPT obstacles have other roots, either a combination of different difficulties or other restrictions such as structural factors. Indeed, practitioner experience hints at practical difficulties in identifying the clear roots of obstacles with frequent simultaneous administrative and legal obstacles" (EC, 2021: 12).

3. OVERVIEW OF SPENDING OF EU COHESION POLICY (2014-2020) IN TRANSPORT INFRASTRUCTURE

KEY FINDINGS

- ECP is still a vital policy instrument to finance transport infrastructure that improves regional accessibility, especially in cohesion countries, thereby contributing to supporting territorial cohesion processes.
- ECP has made a significant contribution to the completion of the TEN-T and had an overall positive impact on improving and modernising the transport networks of EU Member States.
- There is a need to increase transport infrastructure investment in rail (preferably high-speed) and waterways as well as sustainable public transport.
- There is a need for a major shift towards smart, sustainable, cleaner and efficient transport infrastructure to reach the EU goals for greenhouse gas emissions reduction.
- Besides the significant investment in new transport infrastructure, a large portion of the ECP investment was allocated to the renovation of existing transport infrastructure.

This section provides an overview of the spending of the Cohesion Policy on transport infrastructure in the programming period 2014-2020. This analysis covers all types of transport-related investments (for goods and people) financed by the European Regional Development Fund (ERDF) and the Cohesion Fund (CF).

3.1. EU Cohesion Policy: an introduction

Formally implemented in 1989, the EU's Cohesion Policy (ECP) has, over time, become the most financed policy within the EU (EC, 2022). The underlying goal of the ECP is to promote a more harmonious, balanced and cohesive EU territory via a systematic reduction of regional disparities in development towards the ultimate goal of EU territorial cohesion (EC, 2014). As a development and Cohesion Policy, it has been financing a myriad of policy interventions in basically all the dimensions of territorial development (Medeiros, 2019) and cohesion (Medeiros, 2016). This includes the policy goal of improving transport connectivity and infrastructure via the ERDF and, since 1992, the CF. These investments in transport infrastructure were made via several main ECP priorities (Table 1) and Operational Programmes (OPs), either thematic or regional. As would be expected, the ECP has allocated a significant share of its funding to modernising and building infrastructure (Table 2), including the domain of transport.

Table 1: Priorities and development domains of ECP programming periods

Policy Phase	Main Priorities/ Thematic Objectives	Development Domains
1989-1993	- Objective 1: promoting the development and structural adjustment of regions whose development is lagging behind; - Objective 2: converting regions seriously affected by an industrial decline; - Objective 3: combating long-term unemployment; - Objective 4: facilitating the occupational integration of young people; - Objective 5: (a) speeding up the adjustment of agricultural structures and (b) promoting the development of rural areas	- Economic Competitiveness - Social Inclusion
1994-1999	- Objective 1: promoting the development and structural adjustment of regions whose development is lagging behind; - Objective 2: converting regions or parts of regions seriously affected by an industrial decline; - Objective 3: combating long-term unemployment and facilitating the integration into the working life of young people and of persons exposed to exclusion from the labour market, promotion of equal employment opportunities for men and women; - Objective 4: facilitating adaptation of workers to industrial changes and to changes in production systems; - Objective 5: promoting rural development by (a) speeding up the adjustment of agricultural structures in the framework of the reform of common agricultural policy and promoting the modernisation and structural adjustment of the fisheries sector, (b) facilitating the development and structural adjustment of rural areas; and - Objective 6: development and structural adjustment of regions with an extremely low population density (as of 1 January 1995).	- Economic Competitiveness - Social Inclusion
2000-2006	- Objective 1: promoting the development and structural adjustment of regions whose development is lagging behind; - Objective 2: supporting the economic and social conversion of areas facing structural difficulties, hereinafter; and - Objective 3: supporting the adaptation and modernisation of policies and systems of education, training, and employment.	- Economic Competitiveness - Social Inclusion
2007-2013	Convergence: aims at speeding up the convergence of the least-developed Member States and regions defined by GDP per capital of less than 75 % of the EU average; - Regional Competitiveness and Employment: covers all other EU regions to strengthen the regions' competitiveness and attractiveness as well as employment; and - European Territorial Cooperation: based on the Interreg initiative, support is available for cross-border, transnational, and interregional cooperation as well as for networks	- Economic Competitiveness - Social Inclusion - Territorial Cooperation
2014-2020	- Convergence: aims at speeding up the convergence of the least-developed Member States and regions defined by GDP per capital of less than 75 % of the EU average; - Regional Competitiveness and Employment: covers all other EU regions to strengthen the regions' competitiveness and attractiveness as well as employment; and - European Territorial Cooperation: based on the Interreg initiative, support is available for cross-border, transnational, and interregional cooperation as well as for networks	- Economic Competitiveness - Social Inclusion - Territorial Cooperation - Environmental Sustainability - Territorial Governance
2021-2027	1. a more competitive and smarter Europe 2. a greener, low carbon transitioning towards a net zero carbon economy 3. a more connected Europe by enhancing mobility 4. a more social and inclusive Europe	- Economic Competitiveness - Social Inclusion

	5. Europe closer to citizens by fostering the sustainable and integrated development of all types of territories - European Territorial Cooperation	- Territorial Cooperation - Environmental Sustainability - Territorial Governance - Spatial Planning

Source: Author based on European Commission documents

Table 2: Distribution of Structural Funds (in %)

Policy Areas/ Phase	1989-93	1994-99	2000-06	2007-14	2014-20	2021-27
Infrastructure	27	20	38	46	38	41
Investment in People	23	27	34	30	31	32
Productive Environment	45	48	25	29	30	22
Other	5	5	3	5	1	6

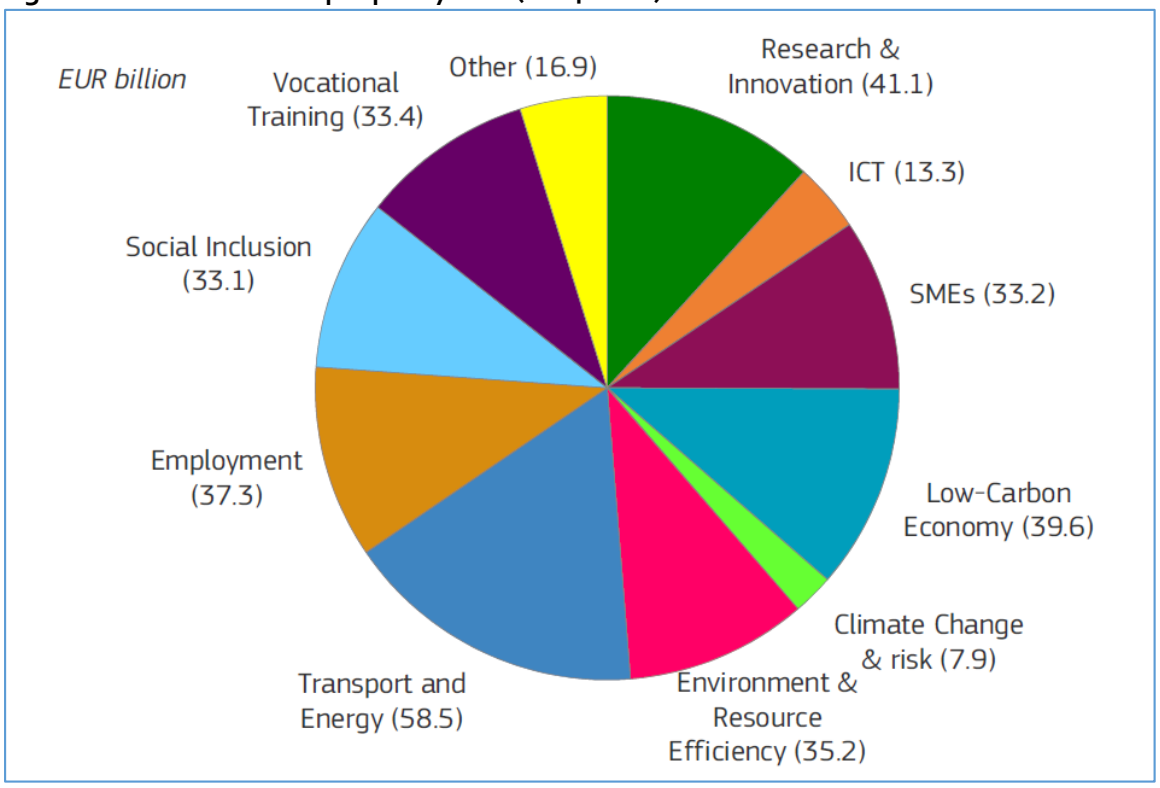
Source: Author

According to the ex-post evaluation report of ECP programmes 2007-2013, "Cohesion Policy has made a significant contribution to the completion of the TEN-T. Member States placed a high priority on TEN-T road and railroad projects in their funding decisions. The total Cohesion Policy allocation to transport was EUR 82.3 billion. Of this, EUR 40.8 billion, or 49%, was related to TEN-T. Of the 3 875 km of new roads constructed with Cohesion Policy support by the end of 2013, 1 817 km, or 47%, were new TEN-T roads. Similarly, of the 3 405 km of railroads that have been either newly built or reconstructed by the end of 2013 with Cohesion Policy support, 1 661 km, or 49%, were TEN-T railroads. Furthermore, over 23 000 km of roads were reconstructed across the 28 Member States by the end of 2013 with the Cohesion Policy support" (EC, 2016: 3-4). Overall, the ECP had a positive impact on improving and modernising the transport networks of EU Member States.

3.2. EU Cohesion Policy 2014-2020 phase

The ECP 2014-2020 phase introduced the selection of 11 thematic objectives as the main investment priorities. Priority 7 embraced the promotion of sustainable transport and the improvement of network infrastructure. As was indicated in Table 2, the policy domain of infrastructure received a significant share of the ECP budget for this policy phase. More concretely, from a total of EUR 349 billion, the domain of transport and energy received the largest share (EUR 58.5 billion, or 17%, see Figure 1).

Figure 1: ECP investment per policy area (2014-2020) – in billion EUR



Source: (EC, 2017)

According to the 2022 summary report of the programme annual implementation reports covering the implementation of ECP in 2014-2020, a total of EUR 535 billion were already spent in that programming period. 71/% of the funding allocated to network infrastructure in transport and energy was already used by approved projects (EC, 2023b) and this was the policy domain which received more funding (Annex 7). According to the 7th Cohesion Report of the European Commission, infrastructure investment in transport generates higher returns, reduces congestion, removes bottlenecks, reduces travel times, leads to more urban trams and metros and contributes to making firms more productive while also contributing to connecting deprived neighbourhoods (EC, 2017). Moreover, the same report concludes that the ECP has contributed to investing in cleaner transport as well as to making more efficient use of existing transport infrastructure, although it recognises the need for increasing the use of rail and waterways as well as public transport.

On a positive note, this ECP phase (2014-2020) aimed to support "more than 4 600 km of TEN-T railway lines, construct 2 000 km of new TEN-T roads and construct or improve 750 km of tram and metro lines" (EC, 2017: 24). Conversely, there is a clear acknowledgment that "investment in transport infrastructure is widely used to promote economic development, but its actual impact on the economy is complex and hard to predict" and "transport investment, especially in areas with a mature network, cannot radically alter market access" (EC, 2017: 39-40). Another general conclusion in the 7th Cohesion Report is the recognition of a shift towards ECP investment in more environmentally friendly transport modes, especially in the context of an increasing volume of goods and number of passengers transported within the EU in the past 20 years (EC, 2017). Similarly, there is a recognition that in rural areas, as in most cross-border regions, the lack of adequate transport infrastructure limits access to markets and services (EC, 2017). Crucially, the 2014-2020 ECP phase has, by and large, contributed not only to building new railway lines and new roads but also to renovating existing ones (Table 3). As regards the TEN-T networks,

motorways and railways received the lion's share of the funding (Table 4). These investments vary significantly in each Member State (Figure 2). In all, "financing of EUR 64 billion from the ERDF and CF was allocated to the 'Connected Europe' objectives in 2014–2020, targeting improvements in rail and road networks and other strategic transport goals. This represented 18% of total Cohesion Policy funding for the period" (EC, 2022: 283).

Table 3: ECP 2014-2020 common indicators and targets as regards transport

Indicator	Km
Railway: total length of new railway line	1 150
Railway: total length of reconstructed or upgraded railway line	8 600
Railway: total length of new railway line, of which: TEN-T	570
Railway: total length of reconstructed or upgraded railway line, of which: TEN-T	4 640
Roads: total length of newly built roads	3 430
Roads: total length of reconstructed or upgraded roads	10 390
Roads: total length of newly built roads, of which: TEN-T	2 000
Roads: total length of reconstructed or upgraded roads, of which: TEN-T	800
Urban transport: total length of new or improved tram and metro lines	750

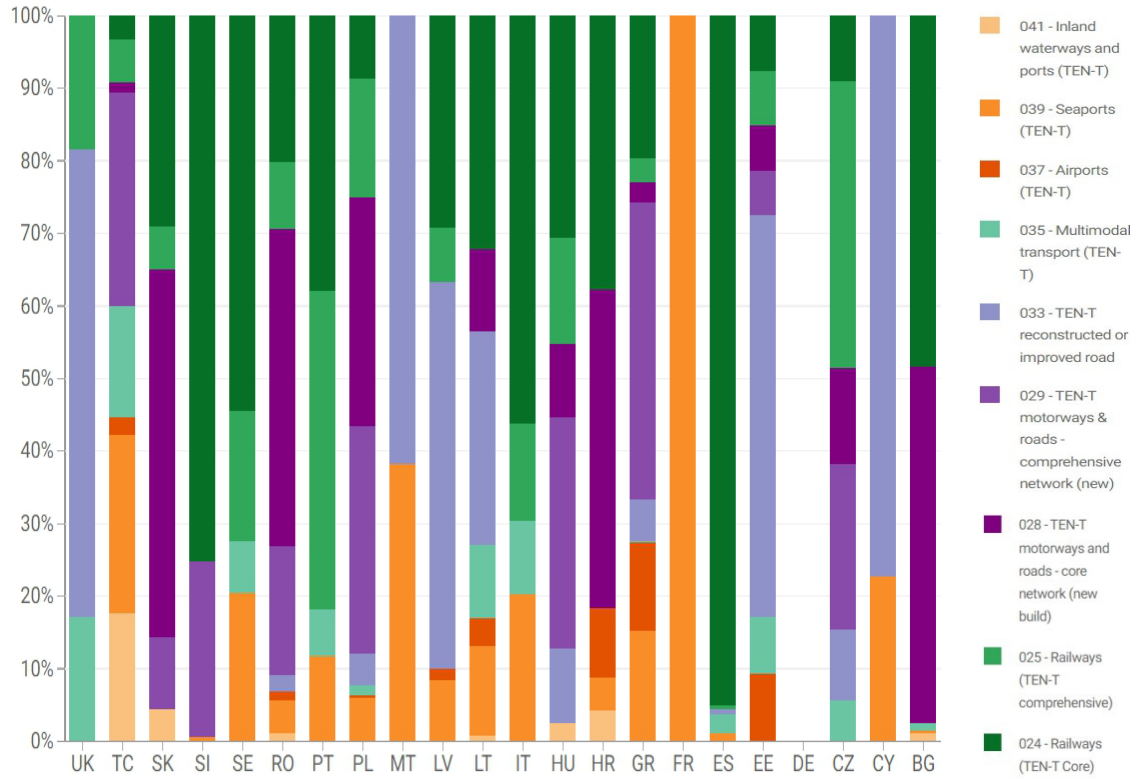
Source: (EC: 2017: 199)

Table 4: 2014-2020 - TEN-T investment plans and progress (ERDF+CF) EU eligible costs decided

Indicator	EUR (in millions)
TEN-T motorways and roads – core networks (new built)	10 617
Railways (TEN-T Core)	8 833
TEN-T motorways & roads – comprehensive network (new)	6 949
Railways (TEN-T comprehensive)	3 217
TEN-T reconstructed or improved road	2 014
Seaports	1 827
Multimodal transport	533
Airports	503
Inland waterways	732

Source: https://cohesiondata.ec.europa.eu/

Figure 2: 2014-2020 - TEN-T planned allocations by intervention and Member State



Source: https://cohesiondata.ec.europa.eu/

4. THE SUPPORT OF EU COHESION POLICY (2014-2020) TO REGIONAL CONNECTIVITY

KEY FINDINGS

- Despite all ECP funding for modernising and improving transport infrastructure in the EU, rural areas continue to lag behind in regional connectivity levels.
- Supporting the construction of new high-speed rail services should be a priority for the ECP, as they have the potential to replace short-haul flights. This contributes to reducing CO_2 emissions, especially considering that half of EU Member States currently do not have high-speed rail services.
- There is a need to focus on improving cross-border and transnational transport connectivity, as this is still a very significant obstacle for cross-border commuters and other interested passengers.
- Without a very detailed analysis, it is not possible to verify a sound direct and indirect relation between regional economic development and the ECP investment in regional transport infrastructure.
- A simple correlation analysis between ECP investment in the major transport infrastructure projects and the change in economic indicators in EU NUTS 2 is negative. That does not signify, however, that these investments are not critical to promoting positive territorial trends. They certainly do, in particular in regions that are not endowed with an adequate transport infrastructure.

This section analyses the support of ECP (2014-2020) for investments in regional connectivity: (i) investments in transport infrastructures connecting urban and rural areas; and (ii) investments in transport infrastructures with regional dimensions and inter-regional aspects and their impacts on the development of local economies.

4.1. The territorial Cohesion Policy goal

The ultimate goal of ECP is to achieve a more cohesive EU territory, which aligns with the policy objective of a more connected EU. For that, there is a need to increase regional transport connectivity in areas that suffer from low levels of regional connectivity in all or certain transport modes. A recent analysis of the EU transport connectivity panorama made by the eighth Cohesion Report (EC, 2022) verifies that, in basically all main transport modes (car, train and airplanes), urban areas (Annex 8) have higher levels of transport regional connectivity (see, for instance, Annex 9). This Cohesion Report provides an updated analysis of the current state of EU regional connectivity and draws the following main conclusions:

- The mobility of people is an enabler of economic and social life.
- The majority of people living in cities have good access to public transport. However, in urban areas, there is a need for increasing sustainable transport modes. Additionally, the performance of cars in metro areas is strongly affected by congestion.
- Outside cities, public transport tends to be less developed in terms of network density and service frequency.

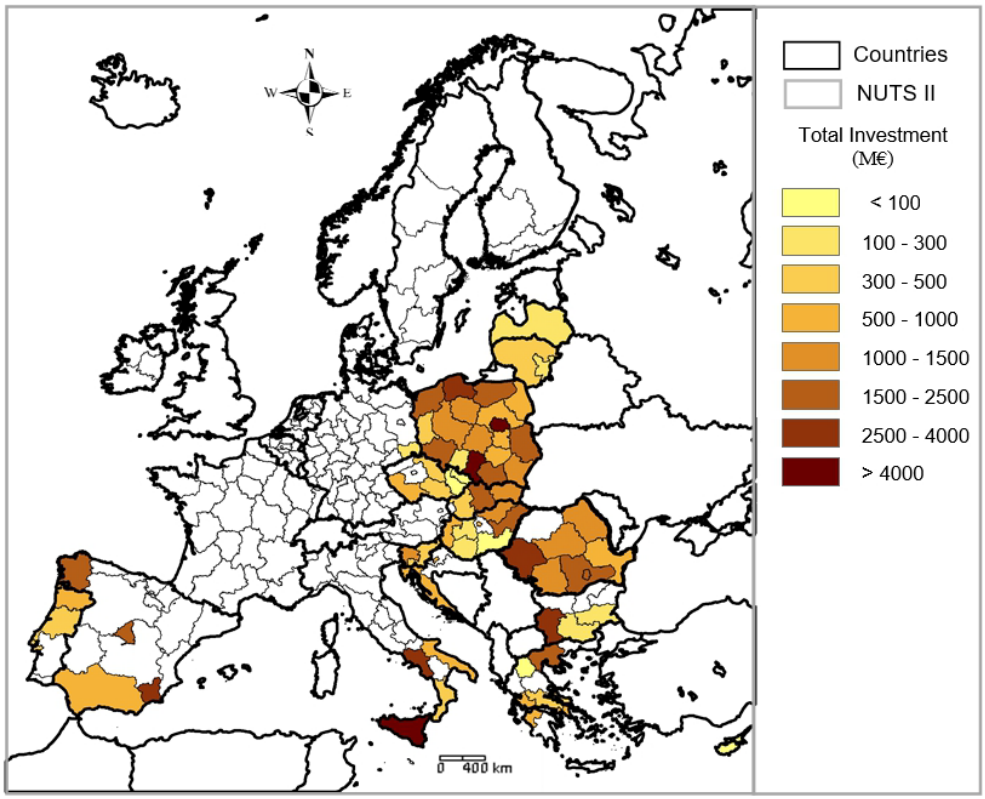
- Improving high-speed rail services can contribute to reducing CO_2 emissions by replacing short-haul flights.
- Around half of EU Member States do not yet have high-speed train networks and yet 31% of total passenger kilometres by rail in the EU use high-speed trains.
- Rail travel across EU borders is still hindered by many obstacles.
- Rail has the potential to successfully compete with aviation over relatively long distances.
- The EU rail network often suffers from lower-speed connections and continues to have numerous gaps; over 5% of city pairs in different Member States are not connected by rail.
- Road performance is higher than rail but remains low in some Member States and rural areas.
- Investment in new motorways can help increase road transport accessibility and performance. In the period 2006–2019, the length of motorways increased in all Member States, except Cyprus.
- Access to passenger flights is highly uneven across the EU.
- Transport performance is lower in border areas. Although EU transport policy places considerable emphasis on cross-border infrastructure investment and connectivity, road transport performance is lower in border areas than in other areas. This difference is more pronounced in rural areas.

Because of this largely unbalanced EU regional connectivity panorama, ECP should concentrate its interventions in EU Member States and regions with lower levels of regional transport connectivity, such as Eastern EU Member States. And indeed, in the ECP 2014-2020 phase, eastern European countries like Poland, Romania, Czechia, Slovak Republic and Hungary were the main financial recipients of the ECP in the policy domain of transport network infrastructure (Annex 10).

4.2. Is there a correlation between ECP investment in regional accessibility and economic development trends in the EU?

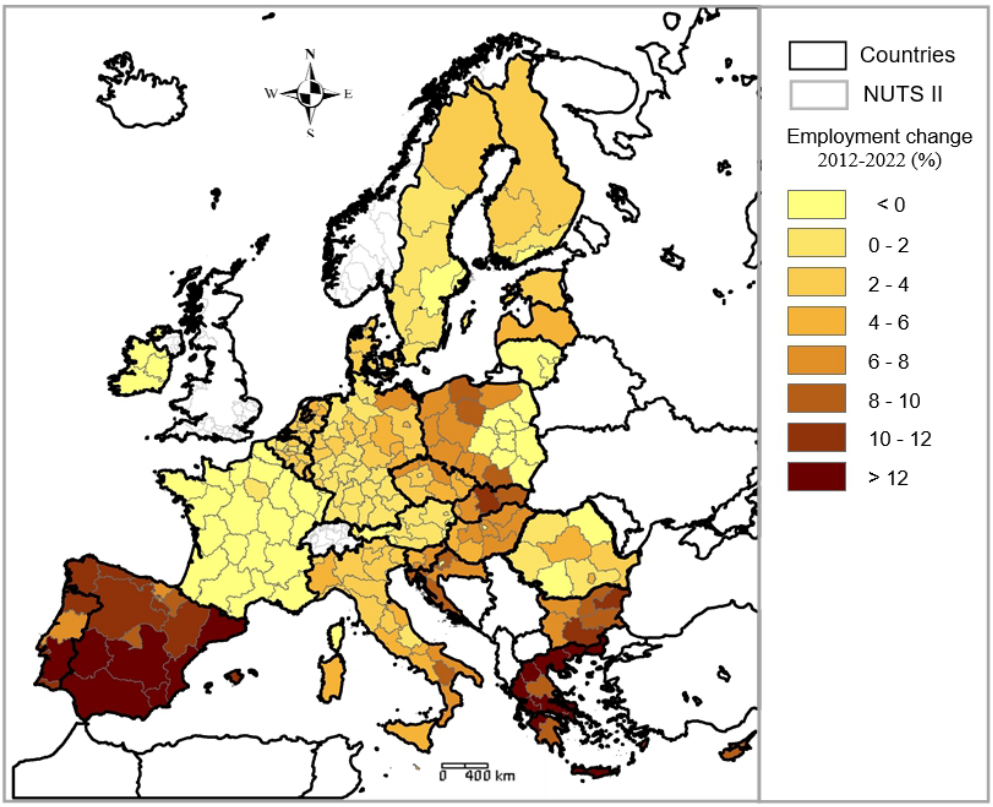
As previously noted, it is extremely difficult to relate economic development trends in a given territory with policy investments in a specific policy sector like transport infrastructure. This is because projects, programmes and policies do not usually act in isolation in a given region. Hence, only a detailed territorial impact assessment analysis could help to report the direct and indirect positive or negative impacts of ECP investment in transport infrastructure. Moreover, in many instances, the investment in transport infrastructure extends often throughout more than one ECP phase and respective transport infrastructure projects are perhaps part of wider railway or motorway networks that require completion to accurately assess their main impacts. Hence, some transport infrastructure evaluations have been extended beyond the 2014-2020 ECP phase (EC, 2022). Even so, data on the ECP investment (2014-2020) on transport infrastructure per EU NUTS 2, provided by DG REGIO (Figure 3), was correlated with employment (Figure 4) and GDP (Figure 5) data for the same NUTS 2. Ultimately, no positive or negative strong relation was found. As can be seen, these NUTS 2 regions cover mostly CF countries and the investment is especially concentrated in Eastern Europe and in particular in Poland.

Figure 3: ECP 2014-2020 major projects in the transport sector



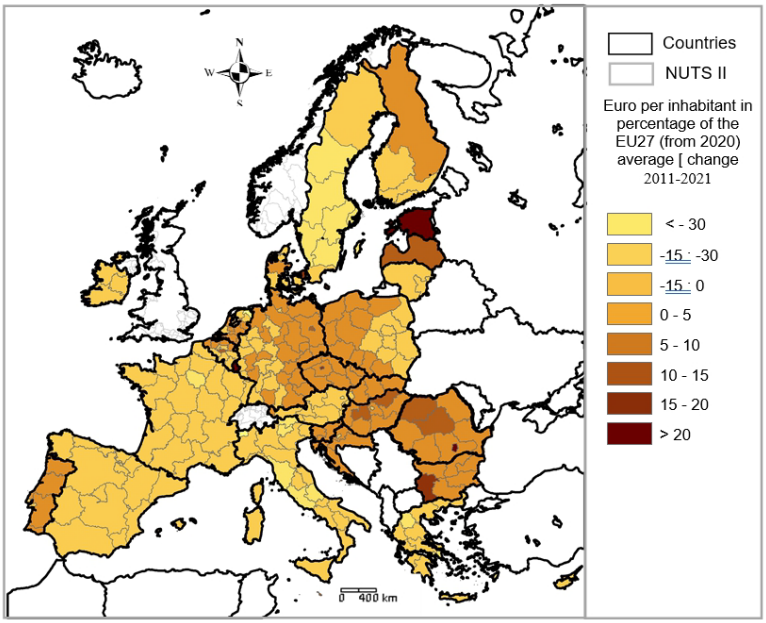
Source: Author - based on EC databases

Figure 4: Variation of employment rate (%) EU NUTS 2 – 2012-2022



Source: Author

Figure 5: Variation in GDP per head (2011-2021]



Source: Author

An overall overview of the change in the selected economic indicators in the previous figures tends to show better improvement in these indicators over a decade in regions financed by the CF (eastern and southern Europe). These are the same regions that received the ECP projects on regional accessibility with higher budgets, according to the EC. If one looks at the distribution of the total ECP funding for EU NUTS 2, it is evident that it has generally favoured eastern and southern EU regions. Hence, a wealth of policy interventions from all ECP policy domains (see Annex 11), alongside non-ECP-financed policies, contributed to the EU regional economic development trends. As the most recent (8th) Cohesion Report points out, "in cohesion countries, transport investment accounted for just under 1.4% of GDP, twice the figure in non-cohesion ones, reflecting the ongoing construction of transport networks, which should support economic development and convergence" (EC, 2022: 251). Similarly, this report suggests that "investment in human capital, transport infrastructure and improved governance appears to be effective in reducing regional disparities" (EC, 2022: 264). The previous remarks from the EU Cohesion Reports (7th and 8th) highlight, however, the concrete positive impacts of ECP investment in regional transport connectivity:

- Reducing cross-border and transnational transport accessibility barriers.
- Promoting sustainable multimodal urban mobility.
- Modernise and renovate old transport infrastructure.
- Enlarge existing transport infrastructure networks both nationally and transnationally.
- Foster the enlargement of high-speed modes of transport infrastructure.
- Removing bottlenecks in key transport network infrastructure.
- Improving the trans-European road and rail network.

In more detail, the 8th EU Cohesion Report concludes that "support for improving mobility in 2014–2020 was centred mainly on developing road and rail networks. This was particularly the case in Poland, where evaluations have verified that the objectives of the investment involved have largely been achieved. The construction of new roads and the upgrading of others have, therefore, improved road safety, reduced the number of accidents (in Poznań by 54% and in Lublin by 74%, for instance), increased average vehicle speeds, shortened journey times as well as reducing road noise and air pollution in cities. Investment in

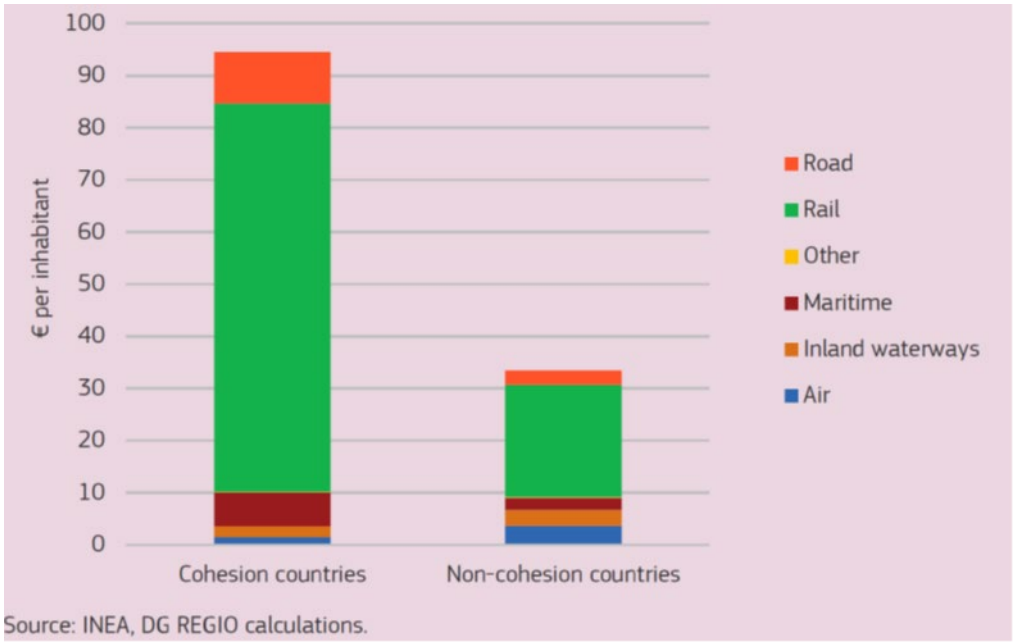
railways has also increased the capacity of the network, speeded up journey times and improved the connections between major cities and between the main economic centres" (EC:2022: 283). Curiously, the Polish report on the impact of ECP on the development of Poland and its regions in the years 2014 to 2020 does not devote any single analysis to the impact of ECP on regional accessibility infrastructure. Again, "evaluations carried out in the 2014–2020 period on the effects of investment in the previous period show similar effects. They indicate (EC: 2022: 285):

- Reduced number of road accidents and fewer traffic bottlenecks from investment in new motorways in Poland.
- Improved safety and reduced journey times in Latvia and Spain result from the construction of new roads and the upgrading of existing ones.
- The modernisation of the rail network, financed from EU funds, made trains more competitive for both passenger and freight transport and increased their use for both in Latvia.
- The modernisation and general improvements led to significantly reduced travel times, especially on high-speed train routes and increased passenger numbers in Spain.
- Reduction of transport costs and stimulation of trade flows in the EU.

Crucially, the 'Connecting Europe Facility' (CEF) is the main source of funding for implementing the EU transport policy, "which complements the ESI Funds by focusing support on cross-border connections (including maritime ones) and interoperability between national transport networks" (EC, 2017: 40). The CEF is thus a key EU funding instrument to promote development processes through targeted infrastructure investment at the European level, funded over the ECP 2014-2020 phase with EUR 22.6 billion, equally divided between cohesion and non-cohesion countries. As seen in Figure 6, the bulk of the investment from CEF was concentrated in railway infrastructure.

In conclusion, assessing the overall impact of regional accessibility-related investment is known to be particularly challenging. Even so, there are several examples demonstrating its positive impacts, for instance, in increasing road security, improving regional economic competitiveness and improving the quality of life of citizens by reducing travel times.

Figure 6: Connecting Europe Facility funding by transport mode, 2014-2020



Source: (EC: 2022: 284)

5. EU COHESION POLICY (2014-2020) ON TRANSPORT INFRASTRUCTURE - EXAMPLES OF SUCCESS STORIES

KEY FINDINGS

- The Interreg-A programme provided an important contribution to mitigating persisting cross-border transport obstacles. However, this programme does not have the necessary financial means to solve all cross-border transport-related obstacles by itself.
- The Interreg-A programme needs to significantly increase its investment in the area of cross-border transport accessibility in many EU cross-border regions with lower levels of cross-border permeability in this policy area.
- Projects such as the Setubal Transport Interface contributed to increasing regional and urban transport mobility by linking rail and bus terminals in one transport hub location.
- The Interreg-A AU-CZ contributed to modernising the cross-border road infrastructure, thus making this cross-border region more attractive to tourism activities.
- Supporting electric modes of public transportation in urban areas contributes to achieving the EU Green Deal policy goals.

This section seeks to illustrate the analysis with a set of examples of success stories or initiatives (e.g. projects, programmes or larger regional policies) supported in the programming period 2007-2013 and/or 2014-2020.

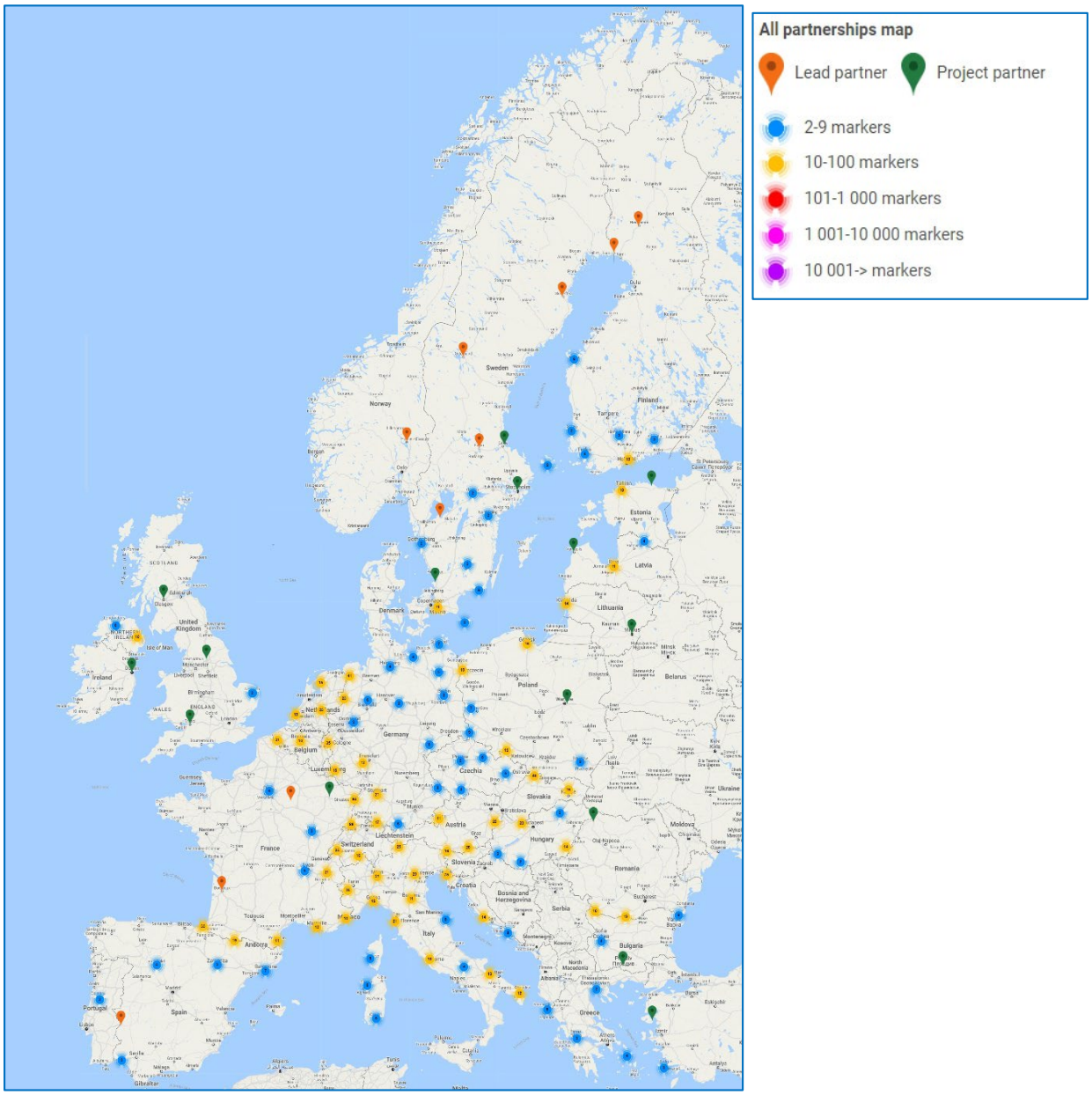
5.1. The mitigation of cross-border accessibility related obstacles via the Interreg-A programme

Introduced in 1990 with the "main goal of preparing border areas for a European Union (EU) without internal borders as well as to compensate for the introduction of the Single Market and soften the blow for border regions" (Medeiros, 2023: 5), the Interreg-A programme supports cross-border cooperation processes between EU adjacent NUTS 3 regions from at least two different Member States. Ultimately, this programme aims to promote territorial development and reduce cross-border obstacles of all sorts, including physical accessibility ones (Medeiros, 2015).

Between 2015 and 2017, the EC organised the cross-border review initiative focused on collecting knowledge and evidence on persistent cross-border obstacles in Europe. Based on the collected data from public surveys, EU citizens considered cross-border accessibility-related obstacles to be the third most relevant cross-border obstacles for their daily lives, after 'legal-administrative' and 'language'-related cross-border obstacles. Indeed, several EC reports (2016b, 2017b, 2018, 2019) and others are clear in demonstrating not only the need to increase cross-border accessibility but also to correct existing regional cross-border accessibility imbalances across EU borders (See Annexes 12 and 13).

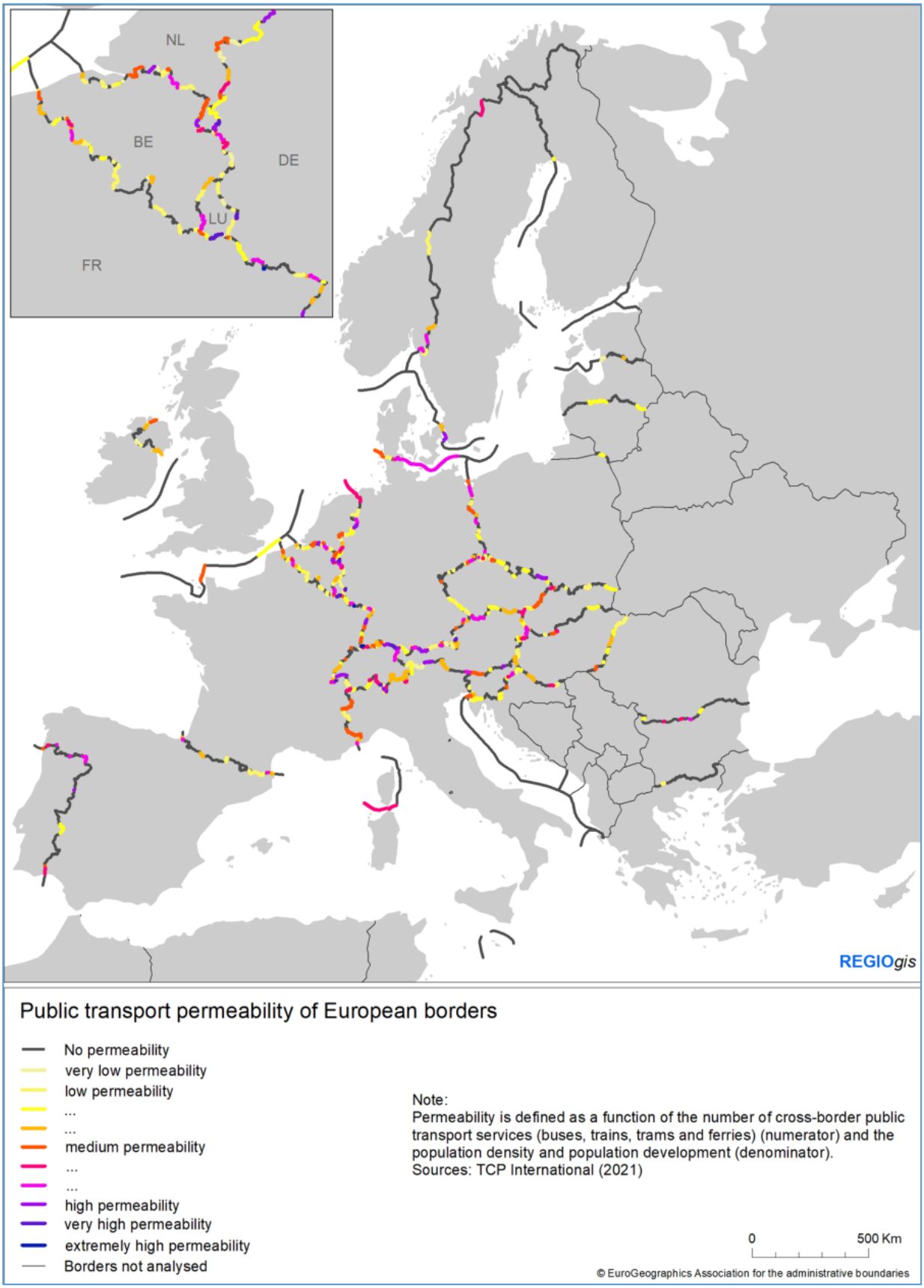
During the Interreg-A (cross-border) 2014-2020 phase, many projects were financed to increase cross-border transport permeability across EU borders, covering many EU cross-border rural areas (Figure 7). Indeed, in general terms, they tended to be mostly concentrated in areas with relatively low levels of cross-border transport permeability, given the relationship between transport passenger supply and offer (Figure 8). These cover cross-border areas around France and Benelux, where cross-border commuting is relatively high when compared with many of the remaining EU cross-border areas.

Figure 7: Cross-border mobility-related Interreg-A 2014-2020 projects (nº) 2016



Source: (Keep.eu database – adjusted by the author)

Figure 8: Public transport permeability of European borders



Source: (EC, 2021: 61)

5.2. Setubal transport interface case-study fiche

- **Country:** Portugal
- **Programme:** Portugal 2020 (2014-2020)
- **Project code:** LISBOA-08-1406-FEDER-000023
- **Intervention area:** Setúbal Municipality (Figure 9)
- **Name:** PAMUS 01 – Interface de Setúbal (Setúbal Interface)
- **Goal:** The Setúbal Interface includes a bus terminal built on the surface, next to the Setúbal train station, with an approximate area of 3 468 m², with parking space for 14 buses as well as operating support areas, a public support area, ticket offices and an underground car park with an area of 3 000m² and a capacity of 117 parking spaces spread over a single floor.
- **Total Funding:** EUR 4 466 487.92
- **ERDF:** EUR 4 188 340.62

Figure 9: Setubal Transport Interface

Source: Setúbal Municipality

Main achievements: Before this interface was operational, Setubal bus terminal was located almost 2km away from the main train station. Now both are geographically connected. This has helped to dramatically facilitate regional/urban transport mobility and, consequently, increase regional accessibility in the Lisbon Metropolitan Area. Indeed, presently, this infrastructure brings together, in one place, public road and rail transport options and an underground car park, with significant gains for municipal and regional circulation. In addition to these new features, there is a parking area for 12 bicycles, the BiciBox, and a space to support cyclists for minor repairs. This interface was an important incentive for people to increasingly use public transport and allows for greater convenience for those who use it. To capitalise on the potential, the municipality combined the creation of this infrastructure with municipal participation in the metropolitan transport pass (Navegante) and in the new road passenger transport network in the Lisbon Metropolitan Area. This Interface project is part of the mobility strategy for the city, embodied in the Setúbal Sustainable Mobility and Transport Plan. It also aims to improve the functional organisation of the transport interface network and its urban insertion in the territory, with a view to reinforcing the use of collective public transport and its respective soft modes.

5.3. Modernisation of the access to the border crossing Czech Republic case-study fiche

- **Counties:** Czech Republic and Austria
- **Programme:** Interreg-A (2014-2020)
- **Intervention area:** Cross-Border Area (Figure 10)
- **Name:** Modernisation of the access to the border crossing Czech Republic (Figure 22)
- **Goal:** The project aims to improve the accessibility to the common natural and cultural heritage of Šumava and the Mühlviertel by modernising access to the border between Zadní Zvonková - Schöneben. This implied the improvement of: Road III/1631, section Bližší Lhota km 7.560 - intersection in km 12.530 (Klápa); Road III/1634, section state border km 0.000 - Přední Zvonková km 3.040 and the Bridge over Pestřice in km 0.060 (independent stage, which was separated from the 3rd stage of the road III/1634, section national border km 0.000 - Přední Zvonková km 3.040). The total length of the renovated roads is 8.07 km. On the Austrian side, the road section between Schöneberg and the border is between km 5.192 and km 6.397 and 0.03 km of the border bridge. That makes a total length of 1 235 km of reconstructed roads.
- **Total Funding:** EUR 7 297 444
- **ERDF:** 6 202 827.4

Figure 10: Location of the case-study Interreg CZ-AU

Source: Google maps

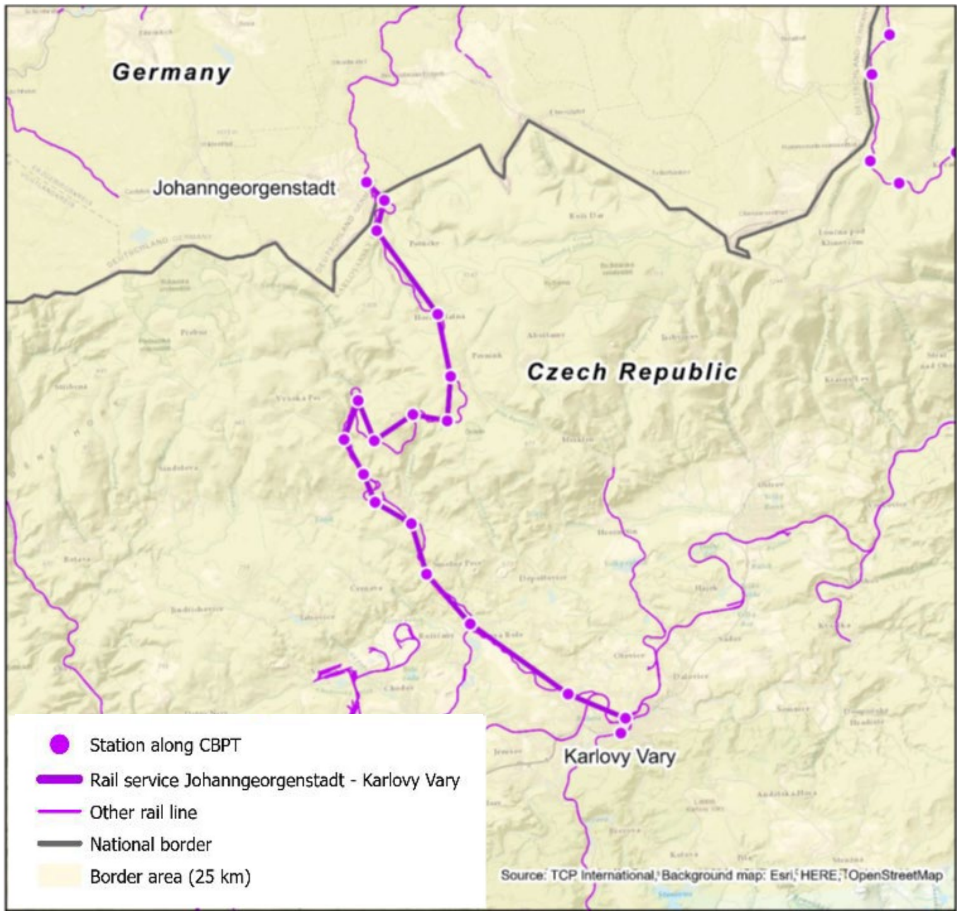
Main achievements: The modernisation of the Upper Austrian-South Bohemian border crossing between Schöneben, Zadní Zvonková and Nová Pec (Redbach district/Český Krumlov district/prachatice district) was completed within two and a half years of construction and financially supported by ERDF funds amounting to EUR 6 202 827.4 from the INTERREG Austria-Czech Republic funding programme. Especially during the summer and winter, tourists and professional commuters benefit from better access to the border area in terms of traffic technology. The outputs of the project are the renovated road sections of the roads No III/1631, III/1634, the SO 202 bridge over the Rotbach (Pestřice) and part of

the road L1558 (Glöckelberger road) in the section Schöneben - national border at a total length of 9.305 km.[1]

5.4 Revitalisation of the line K. Vary Lower Station – Johanngeorgenstadt

- **Counties:** Germany –Czech Republic
- **Programme:** Cohesion Fund (2014-2020)
- **Intervention area:** Cross-Border Area (Figure 11)
- **Name:** Railway connection Johanngeorgenstadt (DE) – Karlovy Vary (CZ)
- **Goal:** The Karlovy Vary Lower Railway Station – Johanngeorgenstadt forms an important regional rail link between the regional town and settlement north of it. Due to the management of the Krušné Hory mountains, it also provides daily commutes as well as recreational tourism. The connection to the German railway network connects Karlovy with the adjacent area of Saxony (Zwickau and its surroundings). The purpose of the construction is to increase the cruising speed on the line by removing permanent line speed limitations.
- **Total Funding:** EUR 19 455 497.56
- **CF:** EUR 16 133 827.25

Figure 11: Location of the case-study DE-CZ



Source: (EC, 2021b) (CBPT stands for Cross-Border Public Transport)

[1] https://keep.eu/projects/20045/Modernisierung-des-Zugangs--EN/

Main achievements: The project allowed for improvements in the integration of railway services' timetables, increased speed and better interconnection with other transport systems since UNESCO sites close to the railway can be easily accessed by public transport. As a result, improving access to more tourism attractions is potentially enhanced. It should be noted, however, that this "railway link is used mainly by commuters from Czechia. (...). Regional stakeholders confirm a limited use by Czech commuters and do not expect more (low unemployment, closures during the pandemic. (...). "For commuters, the connection to other cities in Saxony is important as their jobs are in the next cities, such as Schwarzenberg (about 16 000 inhabitants) and Aue (about 20 000 inhabitants), not in Johanngeorgenstadt. This requires an additional train from Johanngeorgenstadt, adding 25 or 40 minutes, respectively" – (EC, 2021b: 11).

5.5 Development of electric public transport in Szeged

- **Country:** Hungary
- **Programme:** Cohesion Fund (2007-2013)
- **Intervention area:** Urban Area (Figure 12)
- **Name:** Szeged electric public transport development project
- **Goal:** The EU's transport policy encourages environmentally-friendly public transport for sustainable mobility. One of the strategic aims in Széged is to create an attractive, high-quality public transport system that enhances the speed and comfort of daily journeys, discourages car use and thereby provides a liveable environment for the city's residents. [2]
- **Total Funding:** EUR 76 839 119.79
- **CF:** EUR 65 117 898.12

Figure 12: Electric public transport in the case-study Interreg CZ-AU

Source: https://www.eltis.org/discover/case-studies/improving-and-electrifying-szegeds-public-transport-system-hungary

[2] https://trimis.ec.europa.eu/project/developing-electric-public-transport-szeged

Main achievements:

- The new tram 2 to 4.8 km line deployment;
- Development of existing lines 1, 3 and 4 - 18.3 km length;
- Extension of trolley lines no. 8-3.7 km and building of trolleybus line No 10;
- Reconstruction of public transport node by giving preference to public transport (Anna Fountain Kossuth Rókusi traffic light roundabout, Indóház of Calvary Veresács - roundabout…);
- Modernisation of location: Pulz street - tram depot, Csáky street - trolley depot;
- Construction of eight new power stations and expansion of two existing ones;
- Purchase of nine pieces of new, modern low-floor trams and ten new modern low-floor trolleybuses;
- Establishment and increase of seven parking sites;
- Renewal of stops and platforms, taking into account demands of the Equal Opportunity Act;
- Ticketing system design and advanced passenger information. [3]

[3] http://www.ujpalyan.hu/content/71/projekt-informaciok

6. POLICY RECOMMENDATIONS

KEY FINDINGS

- Support a European Transnational Public Transport Mechanism (ETPTM) with an EU vision for an integrated transnational public transport network that provides adequate cross-border public transportation services across EU borders.
- Focus the investment on improving railway networks and, in particular, high-speed rail services as a means to link EU large and medium cities and to replace short-haul flights.
- Focus on improving regional transport accessibility in rural and cross-border areas (these are mostly rural), in all transport modes and providing appropriate transport connections with urban areas.
- Focus on providing railway/metro/tram connections between existing international and regional airports in all EU capitals and main/medium cities. These are still unavailable in several EU Member States.
- Focus on promoting the use of TIA methodologies to assess the main territorial impacts of ECP investment in regional transport accessibility infrastructure.

This section offers a set of policy recommendations for EU policy-makers, first and foremost for Members of the European Parliament, on what could be done (especially at the EU level) to improve regional connectivity through investments in an adequate transport infrastructure.

6.1. Improving cross-border and transnational regional accessibility

Around 30% of EU inhabitants live within the EU internal borders. In rough numbers, it is estimated that around a million cross-border commuters cross the French borders and possibly two million cross EU borders daily (Medeiros et al., 2021). In a context in which cross-border physical accessibility is widely regarded as one of the most relevant cross-border obstacles by Europeans, there is a need to boost the financial capacity of EU Interreg (A – cross-border and B - transnational) programmes to support an European Transnational Public Transport Mechanism (ETPTM) with an EU vision for an integrated transnational public transport network that provides adequate cross-border public transportation services across EU borders. In this domain of cross-border public transport, three EC studies (2017, 2017b, 2019) made the following main recommendations:

- Promote jointly planned cross-border transport networks and services as well as transport infrastructure, including operational aspects like understandable information sources and ticketing systems.
- Promote harmonised legal and administrative standards or systems when operating cross-border transport. This implies mutual recognition or limited derogations from national rules.
- Promote joint management structures like the European Groupings of Territorial Cooperation (EGTC), which can facilitate the establishment and operation of genuine cross-border transport.
- New transport services should be implemented in EU border sections that are currently not sufficiently permeable in transport accessibility but have demand for cross-border public transport.
- EU borders with no or very limited bus services (e.g. Bulgaria and Romania or the Baltic States) need to be given particular attention by ECP to invert this scenario in future programming phases.

- Cross-border public transport should be integrated into domestic transport networks. This requires better coordination of public transport timetables.
- Increase strategic alliances and interaction between public stakeholders and private operators.

Besides a financial reinforcement of EU Interreg-A programmes focusing on systematically mitigating persisting regional transport accessibility cross-border and transnational obstacles, these programmes could also work jointly, both strategically and financially, with existing EU initiatives in the area of transport, like the TEN-T (Medeiros, 2023), to link cross-border medium cities (EC, 2019). Ultimately, an improved cross-border and transnational transport system will improve: (i) levels of EU regional and transboundary connectivity; (ii) access to EU cross-border services; (iii) the potential of cross-border labour markets; (iv) cross-border functional links; and (v) access to domestic transport networks (EC, 2019).

6.2. General recommendations for an improved ECP investment in regional accessibility

As a resident of Portugal who has witnessed the tangible and dramatic improvement and modernisation of the road and specifically the motorway network since Portugal joined the EU, it is easy to infer a few main conclusions from the impact of the ECP on Portuguese regional transport accessibility over the past 40 years: ECP investment in regional accessibility was essential to modernising and extending the motorway road network (Medeiros, 2014). Moreover, the first three Portugal-Spain Interreg-A phases spent 70% of the allocated funds on improving cross-border physical accessibility (roads and bridges – including the most financed Interreg-A project so far – the Guadiana Bridge). However, a lack of an overall territorial development vision led to limited investment in railway infrastructure and only recently has ECP started to foster the investment in sustainable urban modes of transport in Portuguese cities.

As seen, ECP investment in regional accessibility is an essential counterpart of EU investment in regional development policies. In the context of the future ECP, which is due to follow a greener, low carbon transition towards a net zero carbon economy as well as a more connected Europe by enhancing mobility policy approaches, there is a need to better link local, regional and national spatial planning strategies aiming at improving regional accessibility and ECP funding. Put differently, in future ECP phases, available funding for improving regional accessibility should be allocated to finance existing spatial planning strategies that are aligned with green and smart mobility policy goals. In this domain, policy areas such as support for expanding charging networks for electric and hydrogen-driven cars should be made a priority with ECP regional accessibility-related funding. Likewise, the implementation of urban metro systems driven by renewable energy sources in all EU capitals as well as the modernisation and expansion of existing urban metro systems should also be a priority for future ECP investment. Alongside, urban metro systems or fast railway lines should be available to link existing major national airports, increasing transport intramodality. Ideally, future ECP phases should prioritise regional accessibility investment, aiming to link all major and medium EU urban settlements via a green and smart high-speed railway network that can effectively replace many current regional flights and thus contribute to achieving EU Green Deal goals. Furthermore, at the research and development level, to accelerate the adoption of sustainable transportation solutions, ECP should support research on electric car batteries (e.g. solid-state batteries) towards increasing range, safety and charging time. Moreover, research on how to turn existing highways and railways into producers of renewable energy (e.g. solar) should also be supported.

From the previous sections it is possible to see that the bulk of ECP investment in regional transport accessibility is still relevant in the context of the overall budget of ECP and is particularly concentrated in the EU Cohesion countries and more so in Eastern European countries. Additionally, the prime areas of investment are on building new motorways and road infrastructure and to build new and upgrade existing railway lines. The question is: are countries like Poland and Romania making the exact same mistakes that Portugal did, in placing an excessive concentration of ECP funding on building new motorways instead of focusing on modernising and building a more operative and sustainable railway system? Past experiences are indeed useful to provide policy recommendations. With the knowledge of previously studied cases related to the implementation of ECP in several Member States, coupled with the analysis provided in previous sections and the literature review, the following recommendations are proposed for more effective and efficient use of ECP funding to improve EU transport regional accessibility:

- Focus on improving high-speed rail services as a means to link EU medium-sized cities and to replace short-haul flights.
- Focus on improving regional transport accessibility in rural and cross-border areas (these are mostly rural) in all transport modes and providing appropriate transport connections with urban areas.
- Focus on continuing the promotion of sustainable and smart transport mobility and multimodal urban mobility.
- Focus on continuing the modernisation and expansion of main railway networks as well as road, maritime and airport accessibility, with a goal to reduce regional disparities and increase regional transport connectivity.
- Focus on providing railway/metro/tram connections between existing international and regional airports in all EU capitals and main/medium cities. These are still unavailable in several EU Member States.
- Focus on improving the energy efficiency of all vehicle types and transport modes.
- Focus on continuing the financial support for improving transport regional accessibility in the EU's less socioeconomically developed Member States and regions.
- Focus on improving transport links between EU harbours and the rail and road network.
- Focus on promoting and supporting transport planning at the EU level.
- Focus on promoting the use of TIA methodologies to assess the main territorial impacts of ECP investment in regional accessibility.
- Increase ECP's role as a stable funding source for improving transport accessibility, in particular in cross-border and transnational transport networks and rural areas.
- Improve the combination of ECP funding with other financial sources in the area of regional accessibility.

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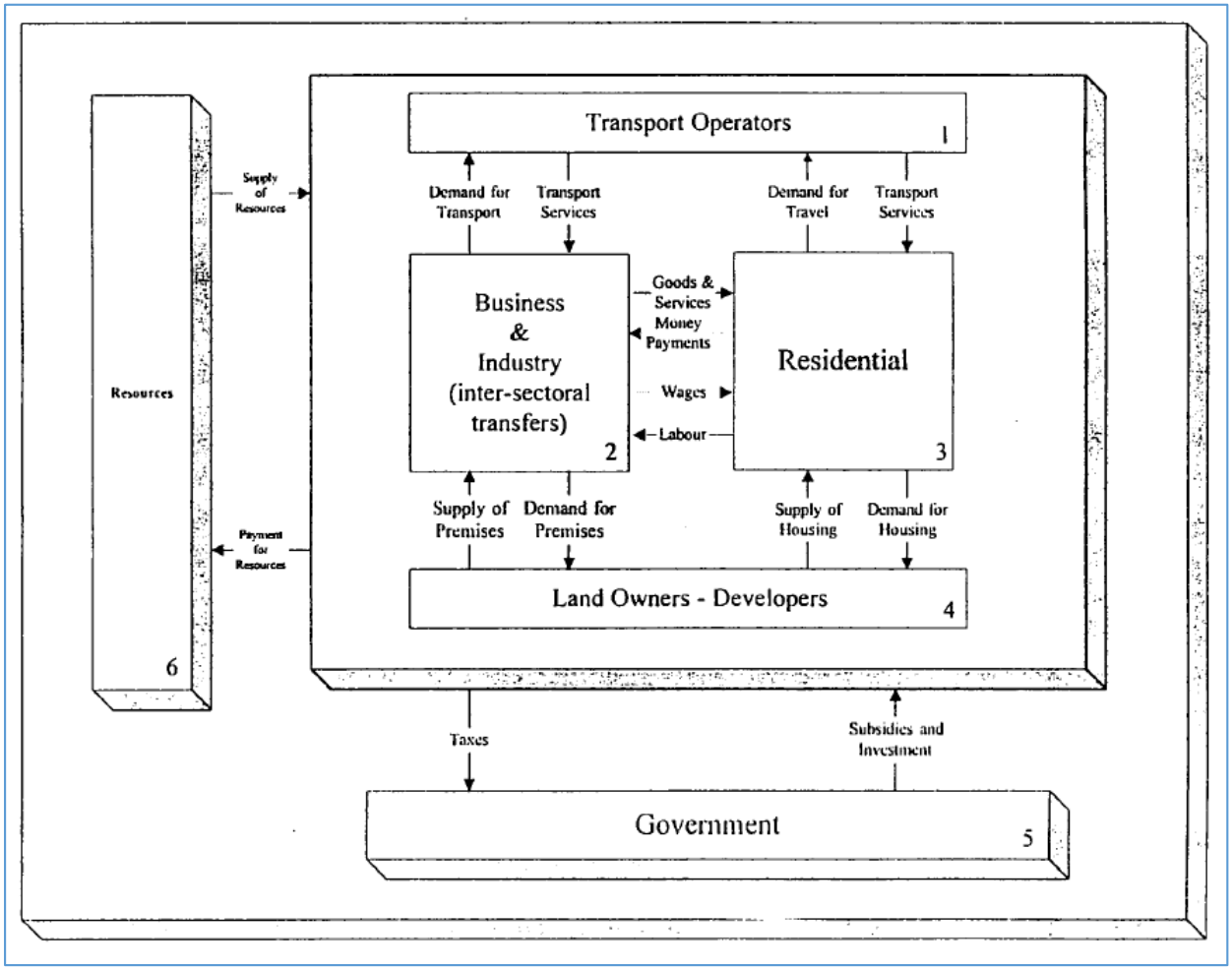
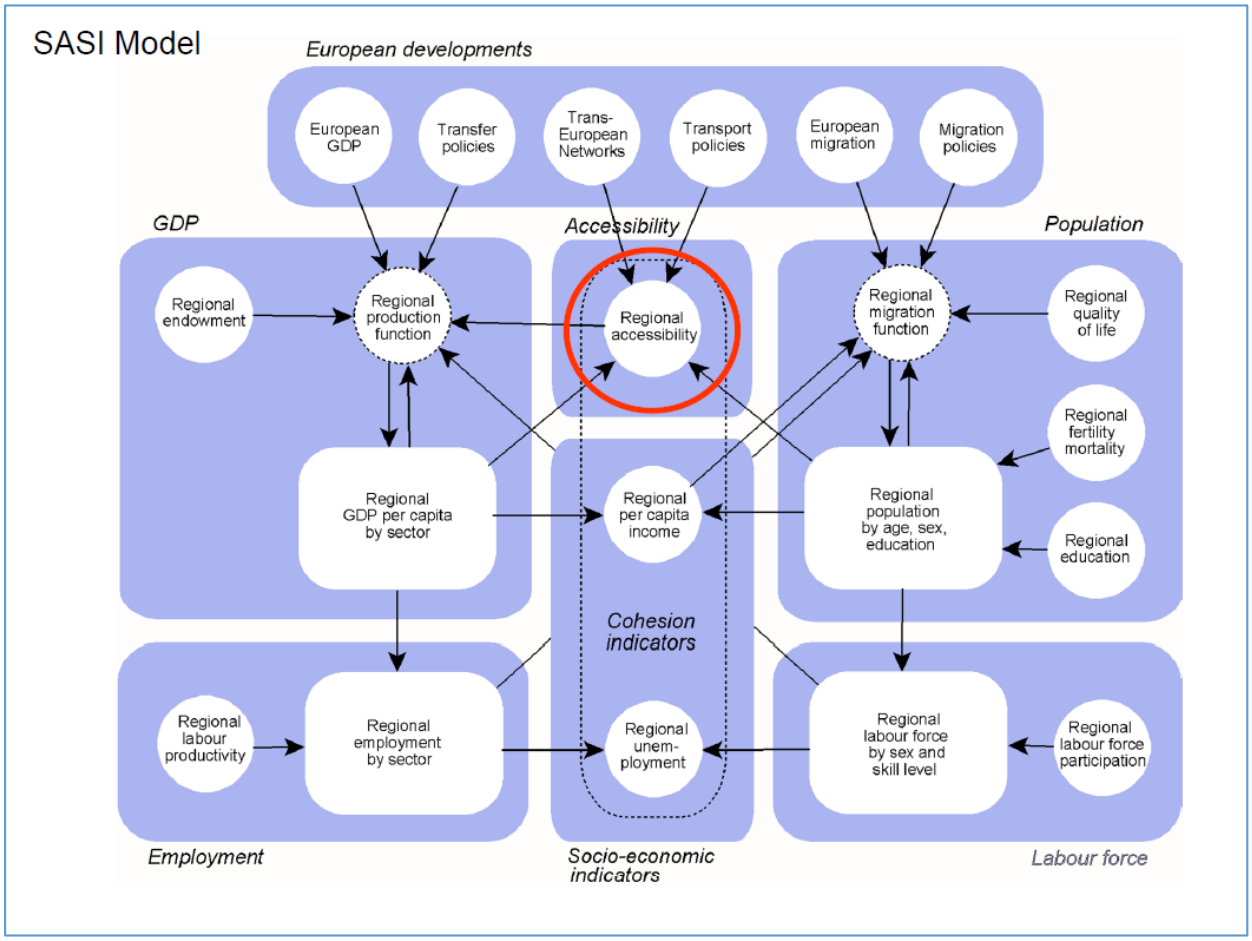
ANNEX

Annex 1: Flows of costs and benefits



Source: (EC, 1996: 7.8)

Annex 2: Main structure of the SASI model



Source: (EC, 1996: 7.8)

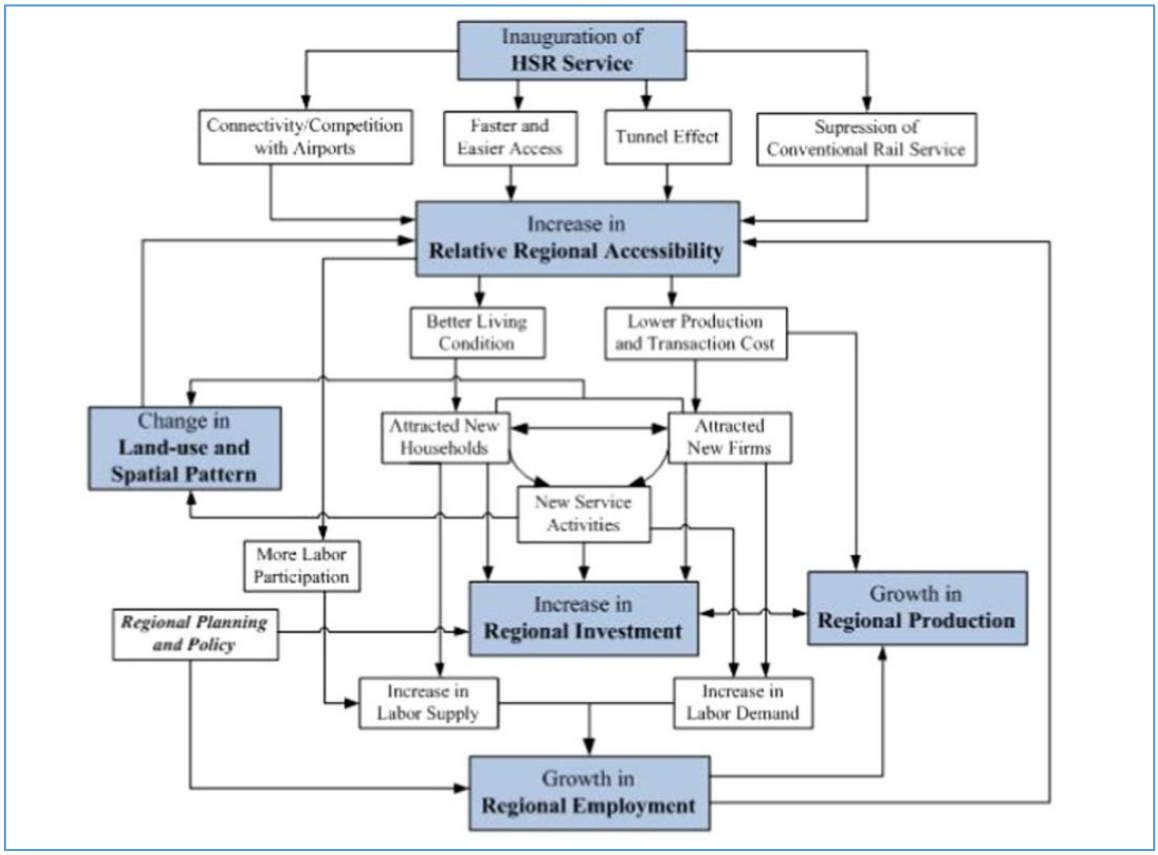
Annex 3: A summary of system accessibility models

Developer(s)	Name of model	Type of measurement	Indicators	Travel mode	Trip purpose	Components	Pros and cons	Practicality
London Borough of Hammersmith and Fulham (1992)	PTAL (Public transport accessibility level)	Distance measurement	Walking time, reliability of the service modes, number of services, and the level of services at access points (e.g., waiting time)	Walking to transit stops	—	Transport, temporal (partial)	The key advantage is that it is easy to understand, but it does not capture traveler characteristic	●
Foda & Osman (2008, 2010)	Ideal Stop Accessibility Index (ISAI), Actual Stop Accessibility Index (ASAI), and Stop Coverage Ratio Index (SCRI)	Distance Measurement	Network and Euclidean Distance	Walking to transit stops	—	Transport (partial)	Considers only the pedestrian network to transit stops	●
Hsiao, Lu, Sterling, and Weatherford (1997)	—	Cumulative Model	Euclidean distance and spatial variables (e.g., population and employment)	Walking to transit stops	—	Transport (partial) and land-use demand and supply (partial)	Highlights a strong relationship between transit service ridership and walking access to transit services	●
Polzin et al. (2002)	Time-of-Day–Based transit accessibility model	Cumulative Measurement	Network distance, service frequency, spatial distribution of population and employment	Walking to transit stops	—	Transport, temporal, land-use demand and supply (partial)	Measures the spatial and temporal aspects of transit accessibility	●
Gan, Liu, and Ubaka (2005)	—	Cumulative Measurement	Network distance and population	Walking to transit stops	—	Transport (partial) and land-use demand (partial) and socio-economic characteristics (partial)	Estimates the level of service for different demographic groups of people	●
Zhao et al. (2003)	—	Gravity/ Cumulative Measurement	Network distance and population	Walking to transit stops	—	Transport and land-use demand (partial)	An exponential curve is weighted based on distribution of walking distances to transit stops	●
Giannopoulos (1989)	—	Gravity-based Model	Travel time and population	Walking, cycling or private car to train stations	—	Transport and land-use demand (partial)	Incorporates the effect of all available transport modes for access to train stations	●
Kocher and Lerner (2007)	Transit Score	Gravity-based Model	Transit service features (e.g., frequency per week), transit mode availability (e.g., train, ferry, bus) and network distance	Walking to transit stops	—	Transport	Incorporates the service level of public transport into the model	●
(Rastogi & Krishna Rao, 2003; Rastogi & Rao, 2002)	ETAI (Environmental Transit Accessibility Index)	Utility Measurement	Network distance, environmental effects and transit mode availability	Walking and cycling to transit stops	—	Transport, individual and temporal (partial)	Based on choice of access stops, but impractical in most cases due to difficulties with data collection	●

● Completely satisfactory; ● Partly satisfactory.

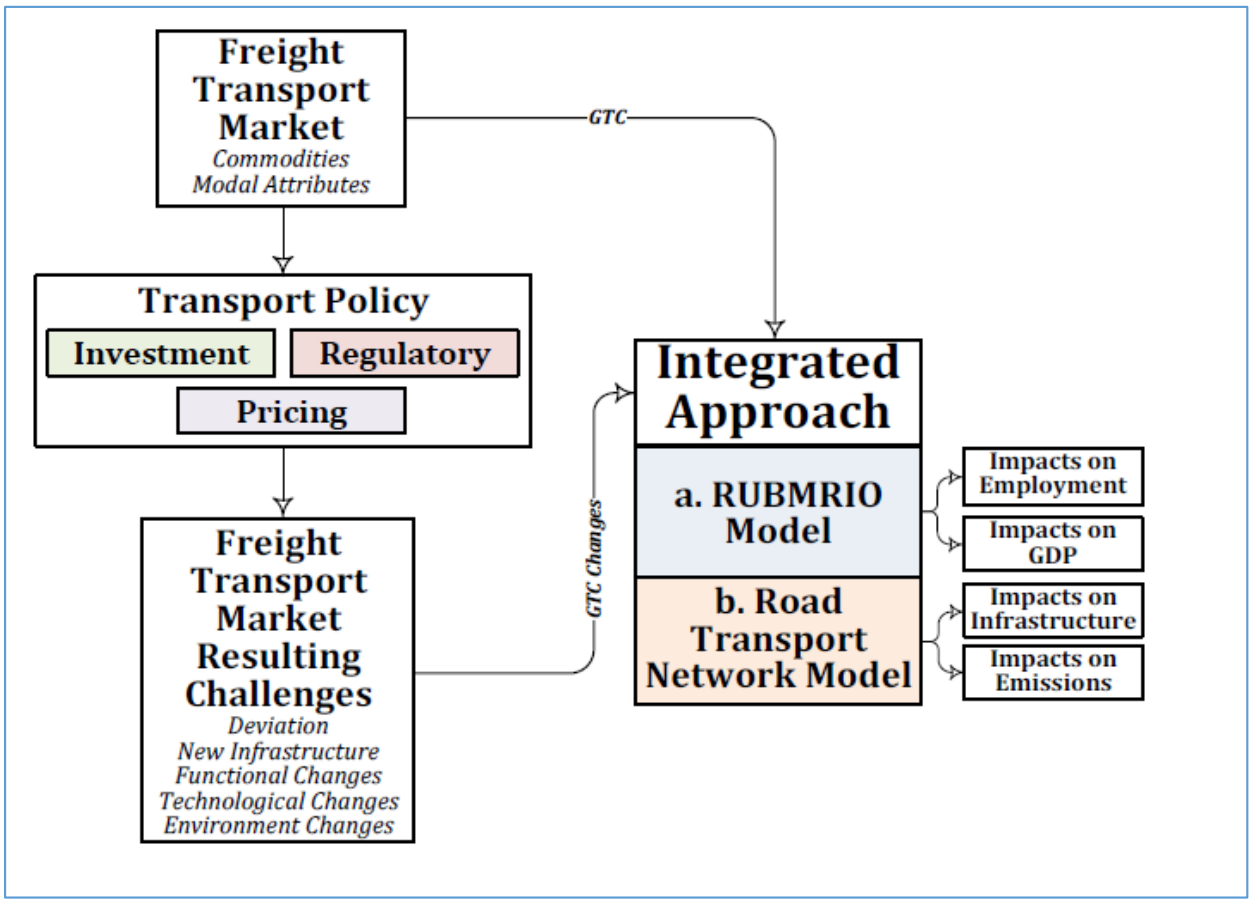
Source: (Malekzadeh & Chung, 2020)

Annex 4: Relationship between high-speed rail and regional development



Source: (Chen G. et al, 2013: 138)

Annex 5: Schematic methodology to assessing economic and transportation impacts of transport policies



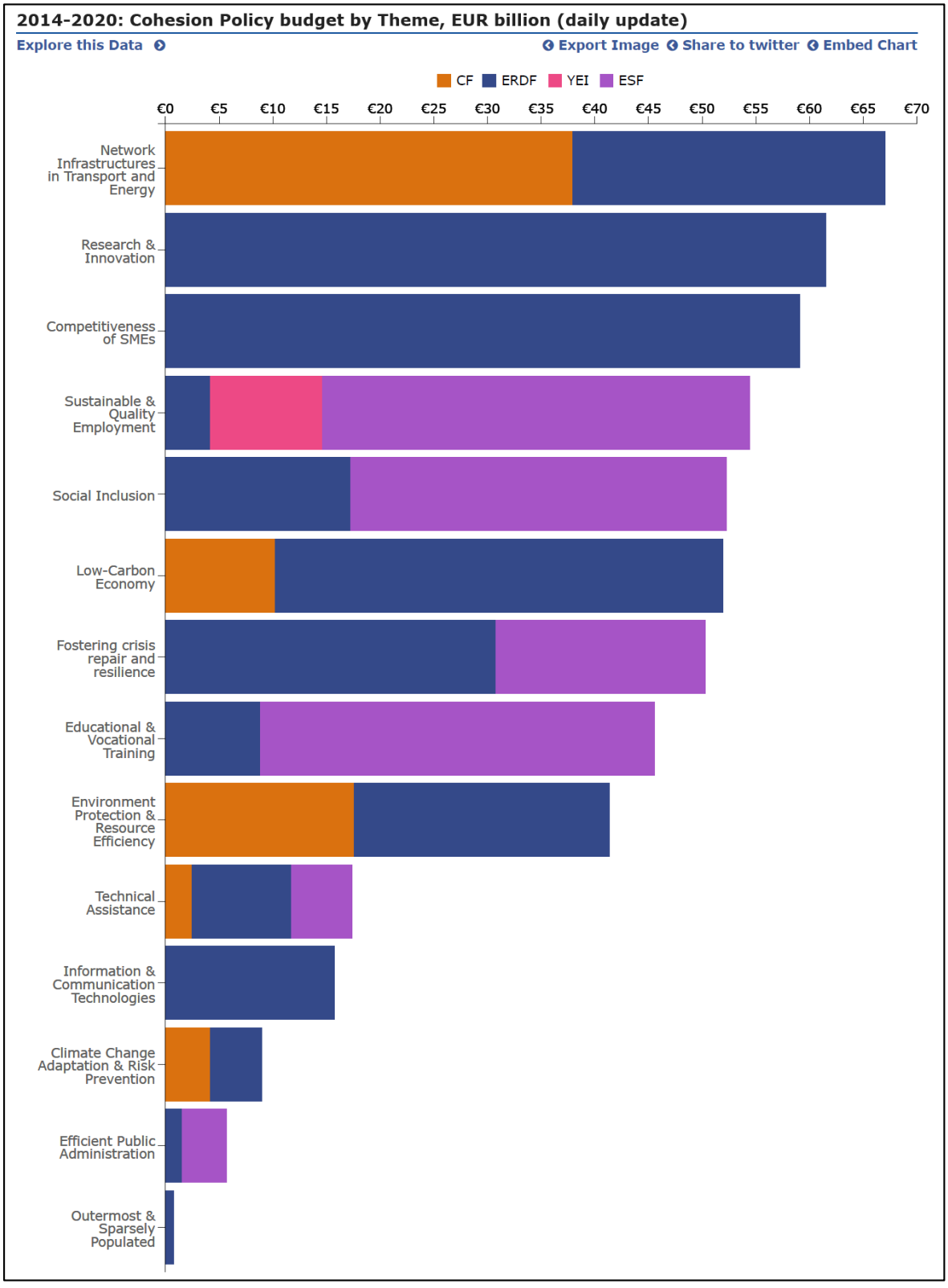
Source: (Guzman-Valderama, 2013: 65)

Annex 6: Cross-border Transport Permeability index formula

TP: CB Transport Permeability index.
TSi: CB Transport Supply index (0-1)
TDi: CB Transport Demand index (0-1)
B: Buses CB intensity (0-1)
T: Trains CB intensity (0-1)
C: Commuters CB intensity (0-1)
P: Population density in the border region (0-1)
D: Demand for CB transports (0-1)
TSi = (B + T)/2; TDi = (C + P + D)/3; TPi = (TSi/TDi)

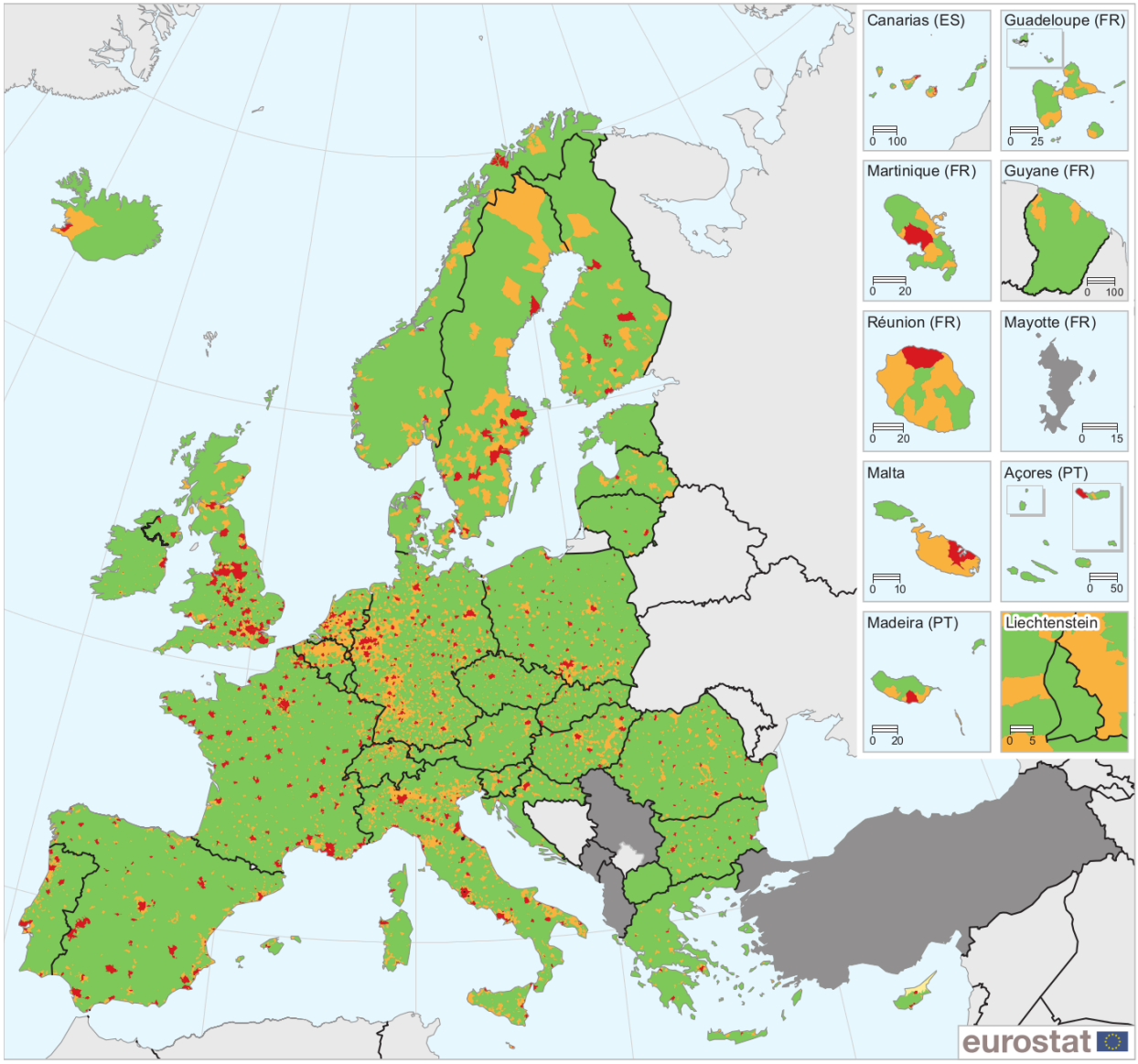
Source: (Medeiros, 2019b: 2)

Annex 7: ECP investment per policy area (2014-2020) – in billion EUR



Source: https://cohesiondata.ec.europa.eu/cohesion_overview/14-20

Annex 8: Degree of urbanisation in Europe



Cities
(Densely populated areas: at least 50 % of the population lives in urban centres)

Towns and suburbs
(Intermediate density areas: less than 50 % of the population lives in rural grid cells and less than 50 % of the population lives in urban centres)

Rural areas
(Thinly populated areas: more than 50 % of the population lives in rural grid cells)

Data not available

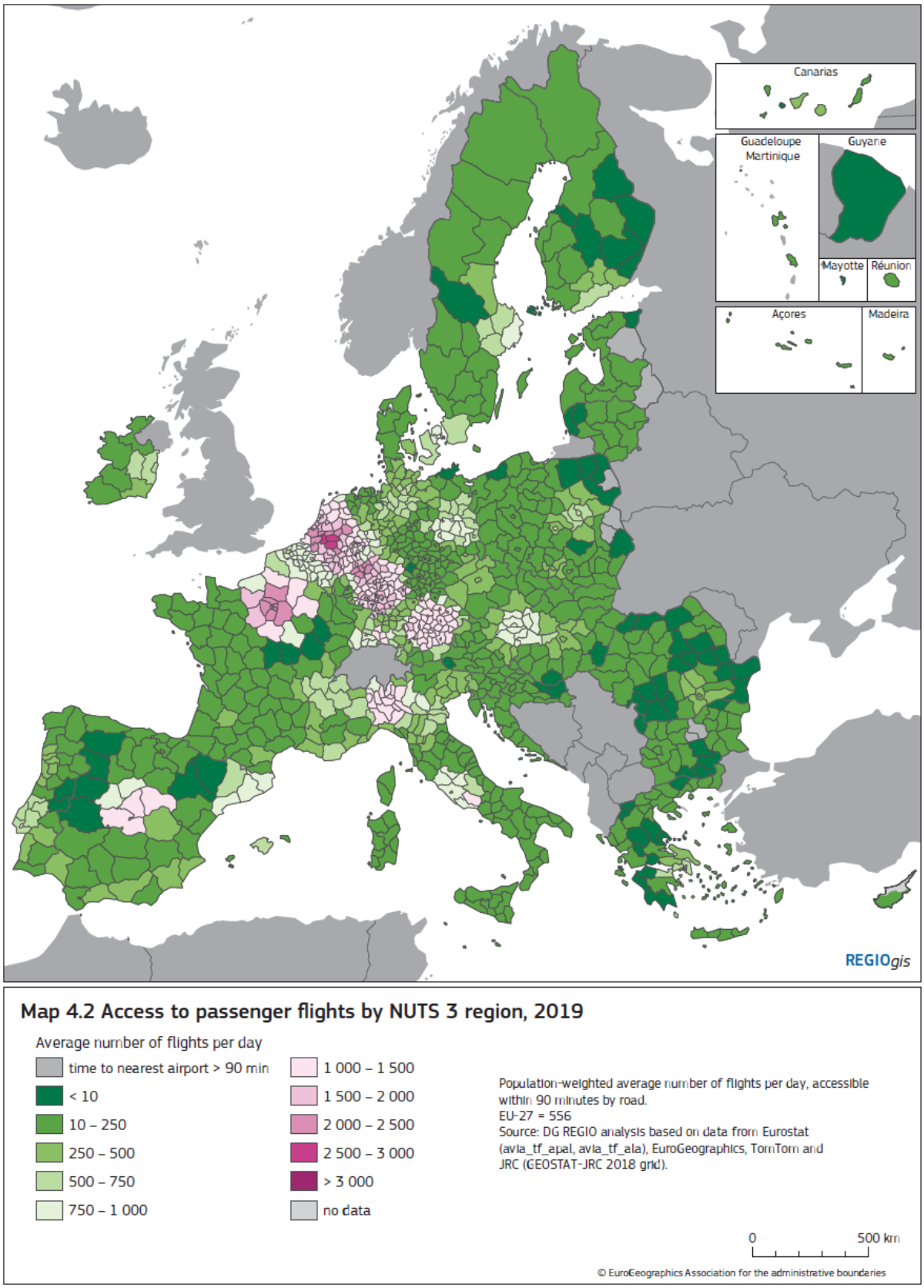
Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat
Cartography: Eurostat — GISCO, 06/2016

0 200 400 600 800 km

(1) Based on population grid from 2006 and LAU 2011.

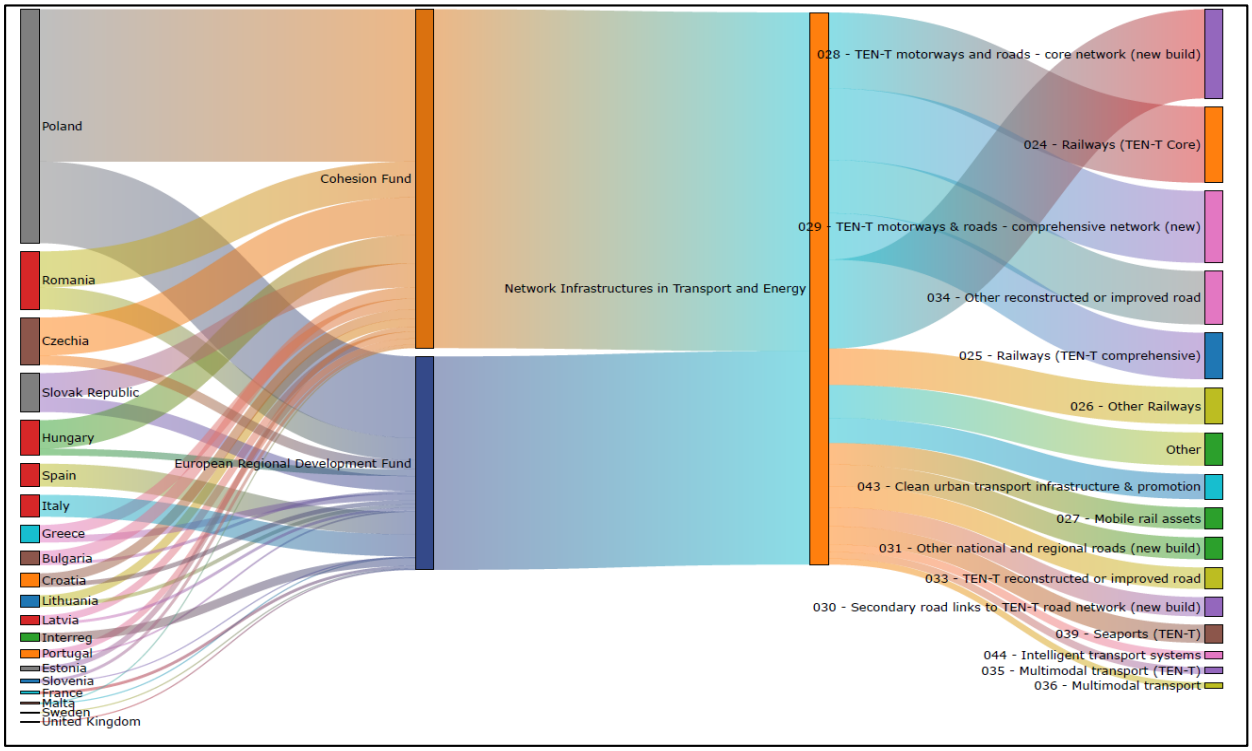
Source: Eurostat, JRC and European Commission Directorate-General for Regional Policy

Annex 9: Access to passengers flights by NUTS III region, 2019



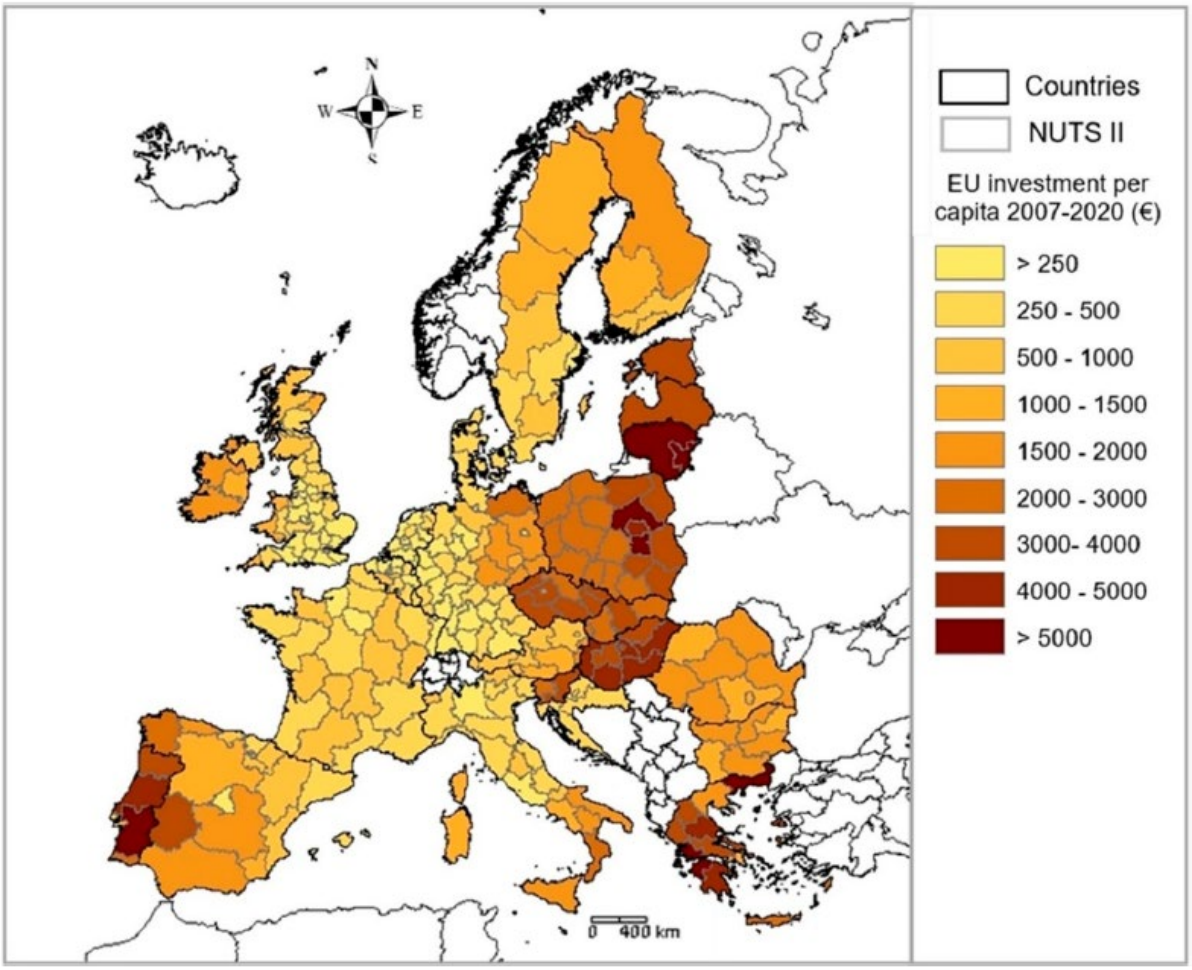
Source: (EC, 2022: 108).

Annex 10: ECP investment in Network infrastructure in Transport and Energy per EU Member State



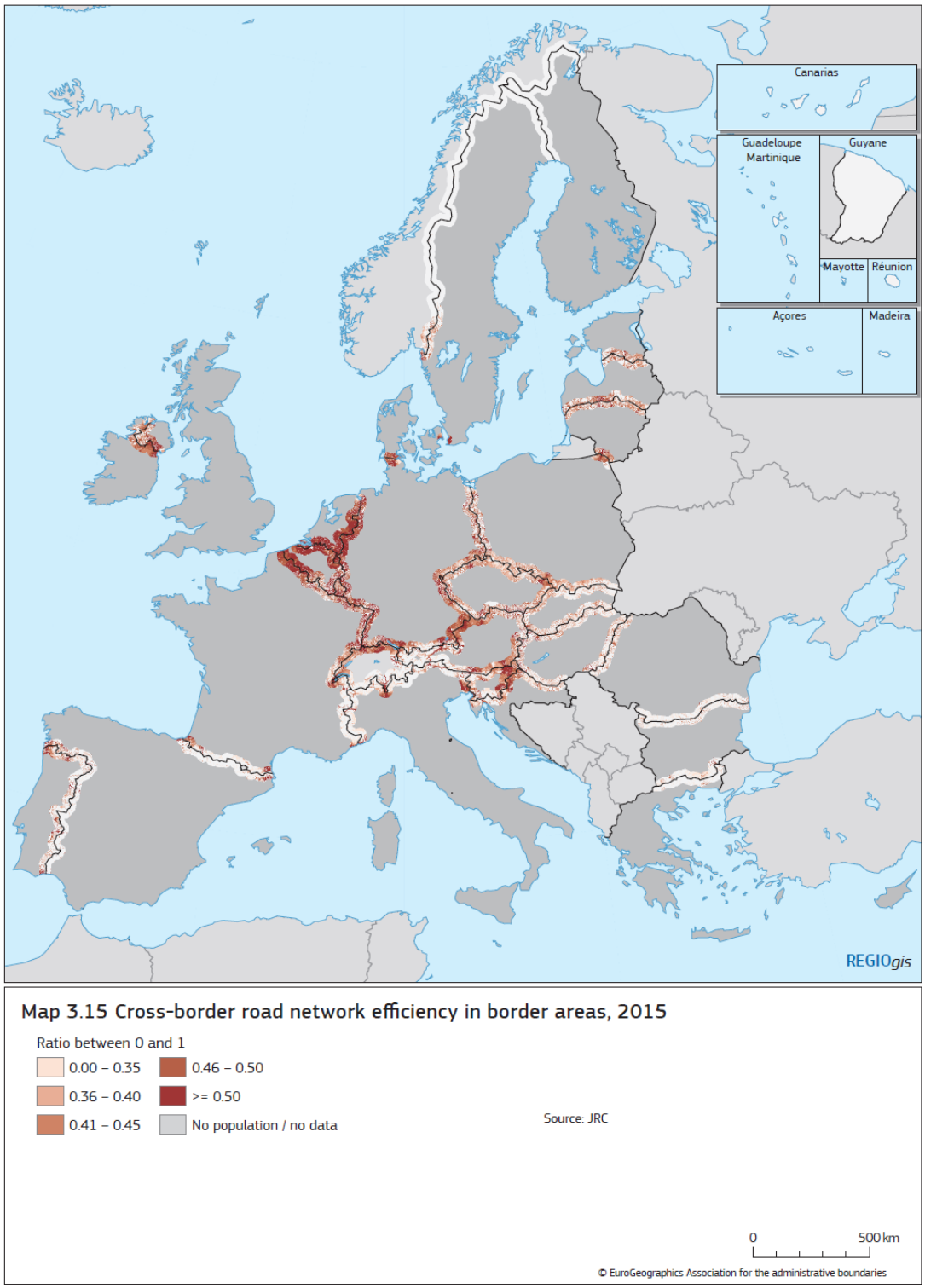
Source: https://cohesiondata.ec.europa.eu/

Annex 11: ECP investment per capita (2007-2020) – EU NUTS II



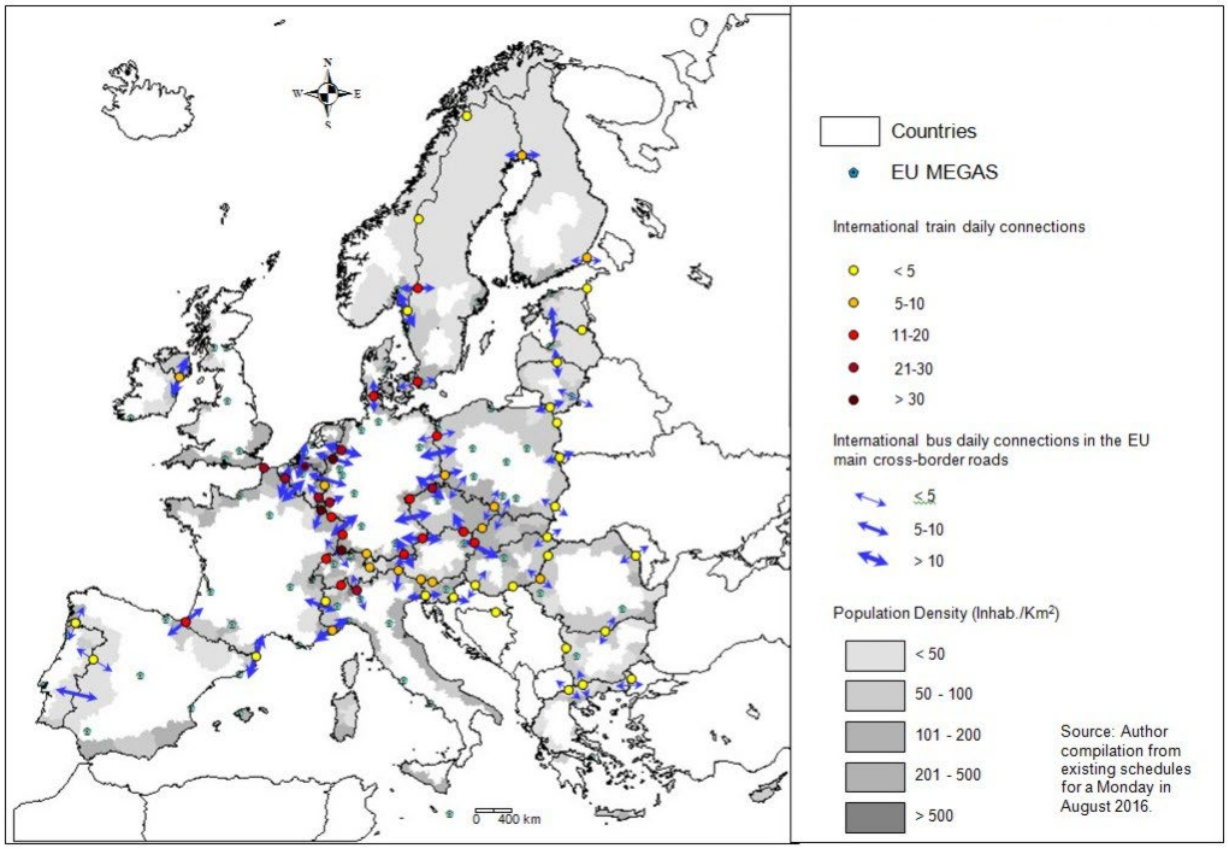
Source: (Medeiros et al., 2023)

Annex 12: Cross-border network efficiency in border areas



Source: (EC: 2017)

Annex 13: Cross-border international transport carriers in the main road and rail crossings – EU 2016



Source: (Medeiros: 2019b)

This study provides an overview of the aspects of regional connectivity through adequate cohesion policy investments in rail and road transport infrastructures, mostly in the programming period 2014-2020. In detail, this analysis covers all types of transport-related investments (for goods and people) financed from the European Regional Development Fund and the Cohesion Fund. Moreover, the study provides concrete policy recommendations relevant to EU decision-makers on how to improve future EU Cohesion Policy investment in the domain of regional connectivity.

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